PASKALS
Advanced Fluid Systems

USER MANUAL

N2 / CNG FLOW MEASUREMENT SYSTEM

Document Name: N2 / CNG FLOW MEASUREMENT SYSTEM USER MANUAL

1. Packing List

The Supply consists of:

Pack-I: N2/CNG Flow Measurement System.
Pack-II: User Manual

2. Do's& Don'ts List

N2/CNG Flow Measurement System requires handling by trained personnel. Kindly go through the User Manual in detail before operating the equipment.

Do's

1. Before starting the test make sure that N2/CNG Flow Measurement System unit must be supplied require gas for which we need to measure flow.
2. Before starting the test make sure that same orifice plate is mounted on flange for which we need to measure flow. For example if we need to measure flow for N2 gas than orifice plate for the same is mounted on flange.
3. Make sure that all joints are properly tightened before starting the test.
4. Please make sure that the setting of DRO is proper.
5. Make sure that system is working in specified pressure range.
6. Make sure proper Electrical power supply is connected to MCB of the system.

Don'ts

1. Don't operate system beyond maximum operating pressure range.
2. Don't Touch Tubes during Testing
3. Don't jump the testing steps (it should be increases gradually).

3. Working principal of Orifice plate Flow Measurement System

An orifice plate installed in a line creates a pressure differential as the fluid flows through it.

As the fluid approaches the orifice the pressure increases slightly and then drops suddenly as the orifice is passed. It continues to drop until the "vena contracta" is reached and then gradually increases until at approximately 5 to 8 diameters downstream a maximum pressure point is reached that will be lower than the pressure upstream of the orifice. The decrease in pressure as the fluid passes thru the orifice is a result of the increased velocity of the gas passing thru the reduced area of the orifice. When the velocity decreases as the fluid leaves the orifice the pressure increases and tends to return to its original level. All of the pressure loss is not recovered because of friction and turbulence losses in the stream. The pressure drop across the orifice increases when the rate of flow increases. When there is no flow there is no differential. The differential pressure is proportional to the square of the velocity, it therefore follows that if all other factors remain constant, then the differential is proportional to the square of the rate of flow.

This differential pressure is measured via impulse lines by a differential pressure transmitter which converts it into an analogue or digital signal which can be processed to provide a display of the instantaneous rate of flow

4. N2/CNG Orifice Plate Design Data

For CNG

Input Data:

Fluid	CNG
Maximum gas flow	0.5 kg/h
Nominal gas flow	0.4 kg/h
Inlet Pressure	3bar
Max flow differential	50mm H2O
Flow temperature	40°C
Molecular weight	18.20967
Ratio of specific heats @ FTP	1.276
Viscosity @ FTP	0.0114 cp
Pipe inside diameter	15.798 mm
Density @ FTP	2.82817 kg/cm3
Orifice dia @ 68°F	2.32513 mm
Base pressure	14.6999998092651 psia
Base temperature	59°F
Barometric pressure	14.6999998092651 psia
Calibration temperature	68°F
Element material	316 Stainless steel
Pipe material	Carbon steel

Output Data:

Beta ratio @ flow temp.	0.147195
Normal flow differential	32 Inch H2O
Uncertainty percent	2.162 %
Normal flow Reynolds No.	785.4
Pressure loss	47.64 mm H2O
Power loss	3.082E-05 hp
Thermal expansion factor	1.00033
Velocity of approach fact	1.00023
Discharge coefficient	0.621203
Gas expansion factor	0.999749
Base pressure factor	1.00204
Base temperature factor	0.998076

For Nitrogen

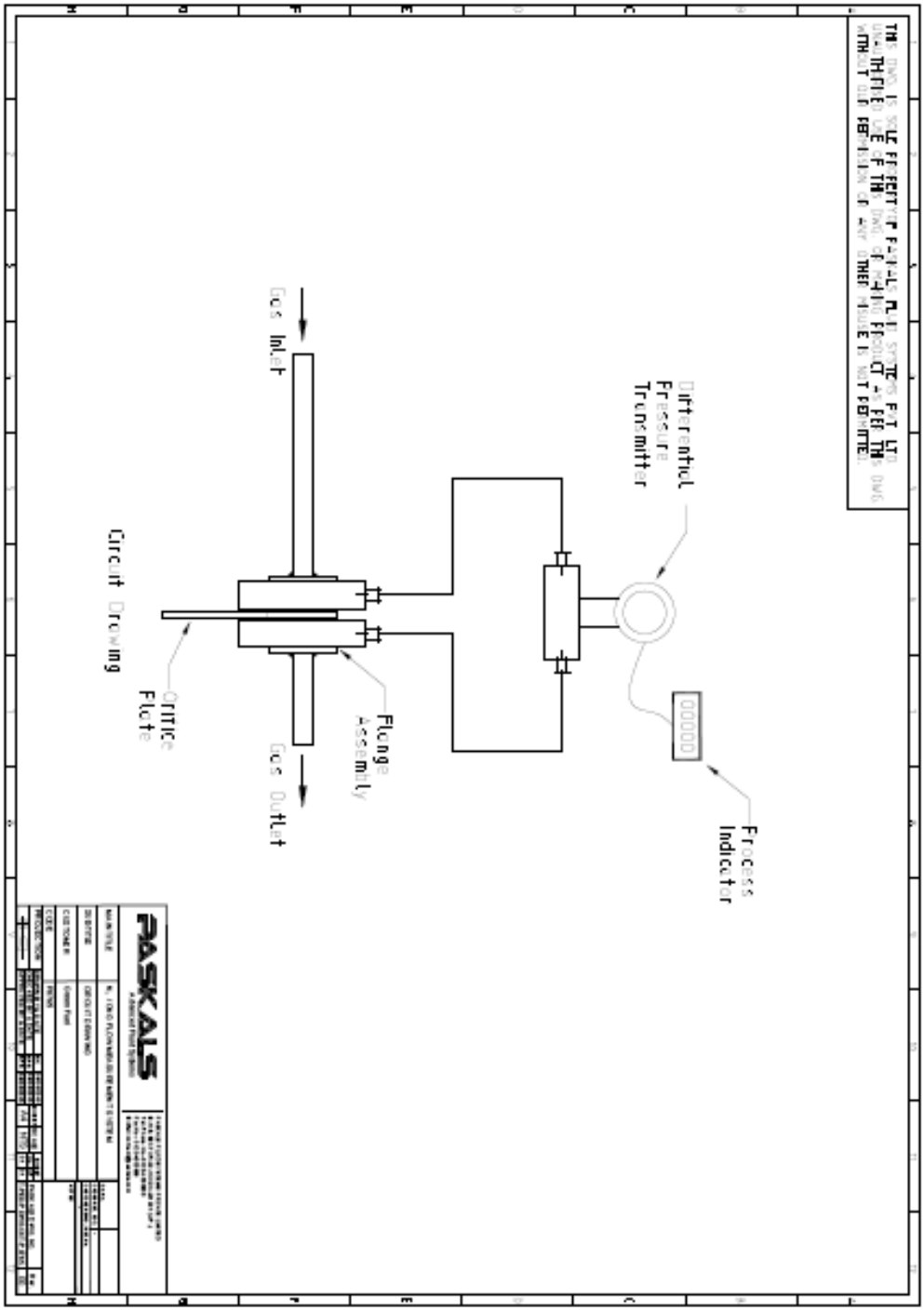
Input Data:

Fluid	Nitrogen
Maximum gas flow	0.5 kg/h
Nominal gas flow	0.4 kg/h
Inlet Pressure	3Kg/cm2g
Differential range	50mm H2O
Flow temperature	40°C
Molecular weight	28.013
Cp/Cv specific heat ratio	1.399
Viscosity @ FTP	0.01835 cp
Pipe inside diameter	15.798 mm
Critical pressure	493psia
Critical Temperature	227.6 degR
Orifice dia @ 68°F	2.06403 mm
Base pressure	14.7 psia
Base temperature	59°F
Barometric pressure	14.7 psia
Element material	304 Stainless steel
Pipe material	Carbon steel

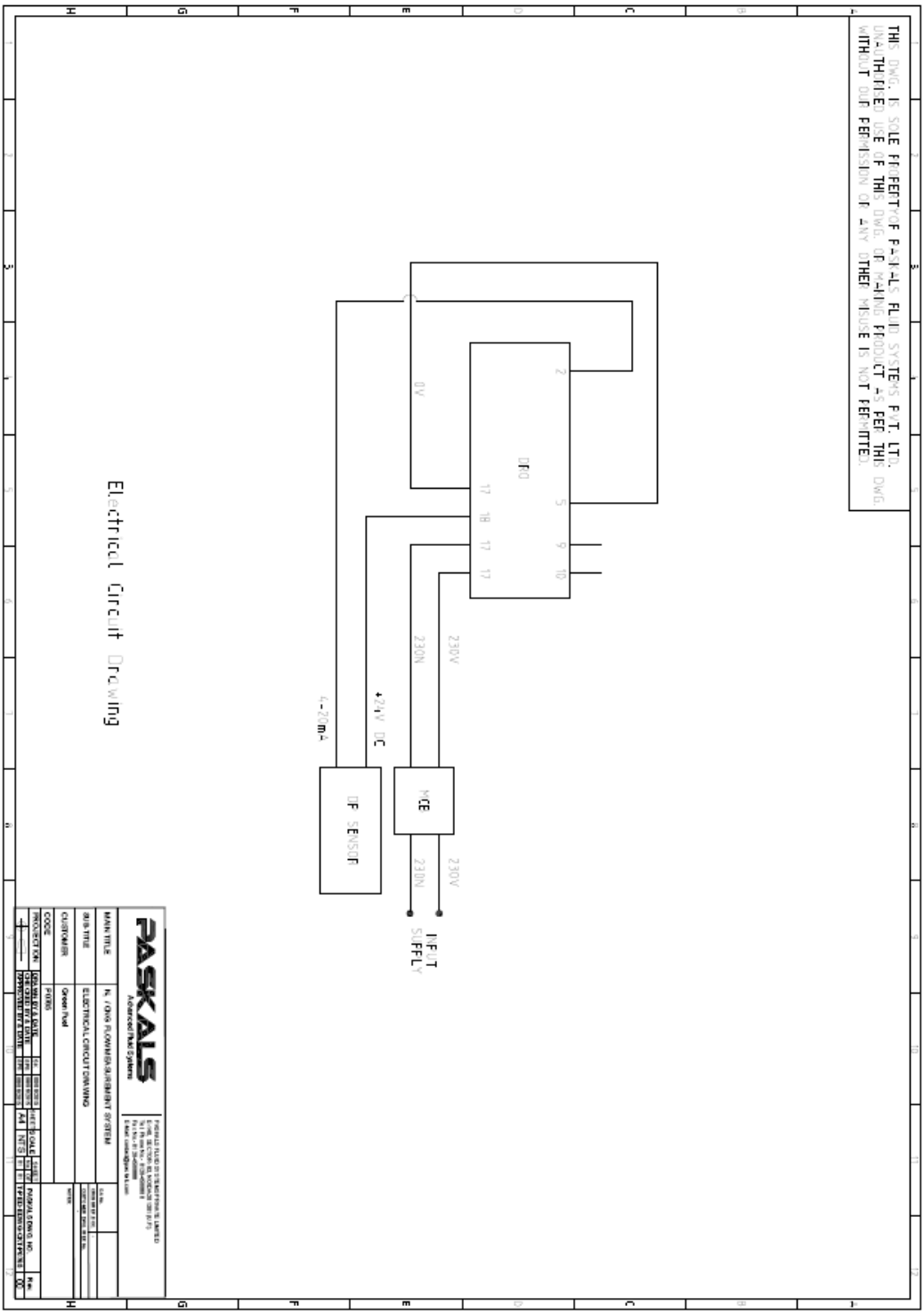
Output Data:

Beta ratio	0.130651
Normal flow differential	1.26 Inch H2O
Accuracy percent	2.99 %
Reynolds Number	488
Pressure loss	47.97 mm H2O
Power loss	0.01536 watts
Thermal expansion factor	1.00068
Discharge coefficient	0.642527
Gas expansion factor	0.999768
Base pressure factor	0.999724
Base temperature factor	1

5. Pneumatic Circuit Diagram of N2/CNG Flow Measurement System



6. Electrical Circuit Diagram of N2/CNG Flow Measurement System



7. System Operation Procedure

Please follow below mentioned Operation Procedure:

For CNG

Step 1 : Install CNG orifice plate **(Orifice dia @ 68°F 2.32513 mm)** on flange .

Step 2 : Make sure all fitting & Orifice plate is tightly installed.

Step 3 : Connect CNG connection at inlet side of orifice Assembly.

Step 4 : Provide Electric supply at MCB.

Step 5 : Switch on the power using MCB inside panel.

Step 6 : Make sure setting of DP sensor & DRO is proper (Please refer user manual DP sensor & DRO for the same) .

Step 7 : Supply CNG at inlet

Step 8 : Now you can read CNG flow rate (present setting is in gram/hour) on DRO .

For Nitrogen

Step 1 : Install Nitrogen orifice plate **(Orifice dia @ 68°F 2.06403 mm)** on flange .

Step 2 : Make sure all fitting & Orifice plate is tightly installed.

Step 3 : Connect Nitrogen connection at inlet side of orifice Assembly.

Step 4 : Provide Electric supply at MCB.

Step 5 : Switch on the power using MCB inside panel.

Step 6 : Make sure setting of DP sensor & DRO is proper (Please refer user manual DP sensor & DRO for the same) .

Step 7 : Supply Nitrogen at inlet

Step 8 : Now you can read Nitrogen flow rate (present setting is in gram/hour) on DRO .

8. List of Standard Components

BILL OF MATERIAL P0765				
S.No.	**Item**	**Specification**	**Make**	**QTY**
1	Orifice Plate for CNG	Service : CNG Operating Pressure : 1-3 Bar, Operating Temp : 40 Deg C , Material : SS 316	Paskals	1
2	Orifice Plate for N2	Service : N2 Operating Pressure : 1-3 Bar ,Operating Temp : 40 Deg C Material : SS 316	Paskals	1
3	Flange Assembly	As per Drawing	Paskals	1
4	Differential Pressure Transmitter	Measuring Range :- 2.5 To 250 m bar ,Housing :- Die Cast Aluminium ,Wetted Parts Material:- Stainless Steel ,Process ,Connection:- 1/4 - 18 NPT , Explosion Protection:- Without , Electrical Connection:- 1/2 - 14 NPT , Fill Fluid :- Silicon Oil , Display:- Integral LCD Display	Siemens ,Model No:- 7MF4433-1DA02-2AC1	1
5	Process Indicator	Universal DRO , Supply-230 VAC	SelecModel : PIC152N-B2	1
6	MCB	10 Amp	L&T	1
7	Enclosure	Size : 380(W) x 600(H) x 210(D) , Panted RAL-7035	Rittal	1

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