LUMASENSE™ TECHNOLOGIES

Dry Heat Loss Transducer – INNOVA MM0057

Uses:

- Measures the dry heat loss the human body is exposed to
- Measures operative temperature
- Provides input values for thermal comfort evaluations and equivalent temperature calculations
- Between 3 and 10 transducers can be used together with the Thermal Manikin "Flatman".

Features:

- Complies with ISO7730, ASHRAE 55, SAEJ2234
- Has the same ratio between heat loss via convection and radiation as the human body
- Has the same angle factor to its surroundings as the human body
- Absorbs the same proportion of long- and short-wave radiation as the human body
- Can be heated to simulate the human body thermally
- Handy size

Introduction

The Dry Heat Loss Transducer MM0057 enables you to simulate the human body thermally. With this transducer you can evaluate the integrated effect on the body of the air temperature, the mean radiant temperature and the air velocity.

The human body's senses are only able to feel heat loss from the body. The dry heat loss transducer is able to measure part of this basic parameter directly, the other part of the heat loss is the evaporative heat loss. This can be estimated by measuring the humidity of the air. By measuring these two parameters it is enough for a thermal comfort evaluation according to ISO7730 — normally four measurement parameters are required.

The term "Equivalent Temperature" is often used instead of Dry Heat Loss. Equivalent temperature, which can be calculated from the dry heat loss, is by definition the uniform temperature of a radiant black enclosure with zero air velocity in which an occupant would have the same dry heat loss as in the actual environment.

The transducer is designed for use with Thermal Comfort Data Logger – INNOVA 1221.

Transducer Design

The Dry Heat Loss Transducer is an ellipsoidal device designed to simulate the human body thermally. It contains a surface temperature sensor and surface heating element. The power to this element is adjusted automatically to bring the surface to a temperature similar to that of a human clothed as specified in the Thermal Comfort Data Logger. The rate of heat production needed to reach this temperature is used as a measurement of the environmental conditions. The operative temperature is derived from the surface temperature sensor of the unheated transducer.

Four major factors were taken into consideration during the design of this transducer:

Size

The size has been chosen so that the ratio between heat loss by radiation and by convection is similar to that of the human body.

The human body has an effective radiation area of only 0.7 times its surface area (due the insides of the arms and legs radiating against the body). If the transducer had the same surface area as the human body, its simple shape would lose 1.4 times more heat by radiation than a human body.

However, the convection heat loss per unit surface area increases as the size of an object is reduced. By reducing the size of the transducer, the mean radiant temperature and air temperature have the same weighted influence on the transducer as on a person.

Shape

The shape of the transducer is determined by the need to obtain the same angle factor to the individual room enclosures as for a human being. This has been achieved by using an ellipsoid shape.

Color

The transducer's Color and emission coefficient have been chosen so that the long-wave radiation absorbed by the transducer is the same as that of both a naked and

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a dressed person. It is not possible to simulate people in both dark and light colored clothing for short-wave radiation. The grey Color chosen simulates both naked people and people dressed in light colored clothing.

Orientation
People don't maintain the same posture. For this reason, the transducer has three settings: vertical, 30˚ from the vertical, and horizontal, which represent the body in the standing, sitting and lying positions respectively.

Cable Connections
The integral cable supplied with the transducer is fitted with a standard 7-pin DIN plug. Electrically, the temperature registration part of the transducer is equivalent to a Ni1000 resistor in a four-wire configuration. This means, extension cables can be used without a loss of accuracy.

Evaluate Thermal Comfort

The heat loss value from this transducer enables you to evaluate the thermal comfort and calculate PMV values according to ISO7730 (PMV values are calculated using dry heat loss, humidity, Clo. and Met. rates). The Equivalent Temperature is also able to be calculated.

Thermal Mannequin

For thermal comfort evaluations in non-uniform conditions, for example in vehicles, measurements in several positions maybe necessary. By using a number of MM0057 transducers (between 3 and 10) a simple thermal mannequin can be made for this application.

SPECIFICATIONS:

Direct Measurement Range:
With two MM0057 connected to a 1221 and a max. ambient temp. of 45˚C: 3.5 Met

With six MM0057 connected to a 1221 and a max. ambient temp. of 45˚C: 1.6 Met

Measurement Accuracy:
±0.4W/m2 or ±2%; which ever is greater

Response Time: signal will settle within 360 sec

OPERATIVE TEMPERATURE:
Measurement Range and Accuracy:

5 to 40˚C	range ±0.5˚C
(41 to 104˚F	range ±0.9˚F)
-20 to 50˚C	range ±1.0˚C
(-4 to 122˚F	range ±1.8˚F)

Response Time:
1min. to 50% of step change, 10min. to 90% in still air

Integral Connection Cable:
Length 3m; connected to associated equipment via a 7-pin DIN plug

Electrical Output:
Equivalent to a Ni1000 signal

WEIGHT:
230g (8oz.) (including cable)

DIMENSIONS:
Length: 160mm (6.3in) excluding handle
Diameter: 54mm (2.1in)

CE	**COMPLIANCE WITH STANDARDS** CE-mark indicates compliance with EMC Directive and Low Voltage Directive.
Safety	EN 61010-1 (1993) & IEC 1010-1 (1990): Safety requirements for electrical equipment for measurement, control and laboratory use.
EMC Emission	EN 50081-1 (1992) : Generic emission standard. Part 1: Residential, commercial and light industry. EN 50081-2 (1993): Generic emission standard. Part 2: Industrial environment. CISPR 22 (1993): Limits and methods of radio disturbance characteristics of information technology equipment. Class B Limits. FCC Class B limits.
EMC Immunity	EN 50082-1 (1992): Generic immunity standard. Part 1: Residential, commercial and light industry. EN 50082-2 (1995): Generic immunity standard. Part 2: Industrial environment. **Note:** The above is guaranteed using accessories listed in this Product Data sheet only.
Temperature	IEC 68-2-1 & IEC 68-2-2: Environmental Testing. Cold and Dry Heat. Operating Temperature: -20 to +50°C (-4 to 122°F) Storage Temperature: -25 to +70°C (-13 to 158°F)
Humidity	IEC 68-2-3: 90% RH (non-condensing at 40°C).
Mechanical	IEC 68-2-6: Vibration: 0.3 mm, 20m/s², 10-500 Hz. IEC 68-2-27: Shock: 1000 m/s². IEC 68-2-29: Bump: 1000 bumps at 250m/s².

Ordering Information

MM0057 Dry Heat Loss Transducer

Optional Accessories

1221	Thermal Comfort Data Logger with UA1278 Dry Heat Loss Module
KE0357	Transducer Carrying Case
UA0588	Transducer Mounting Adaptor
UA0803	Tripod
DH0492	Tripod Mounting Adaptor for 3 Transducers
UA1347	Tripod Mounting Adaptor for 4 Transducers
UA1348	Tripod extension rods (3)
AO1430	Adaptor Cable for MM0057 to 1212
AO0285	Extension Cable
AO0285/y	Extension Cable (definable length up to 20m, y is length in meters)
EA6020	Termal Manikin "Flatman"

LumaSense Technologies reserves the right to change specifications and accessories without notice.

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