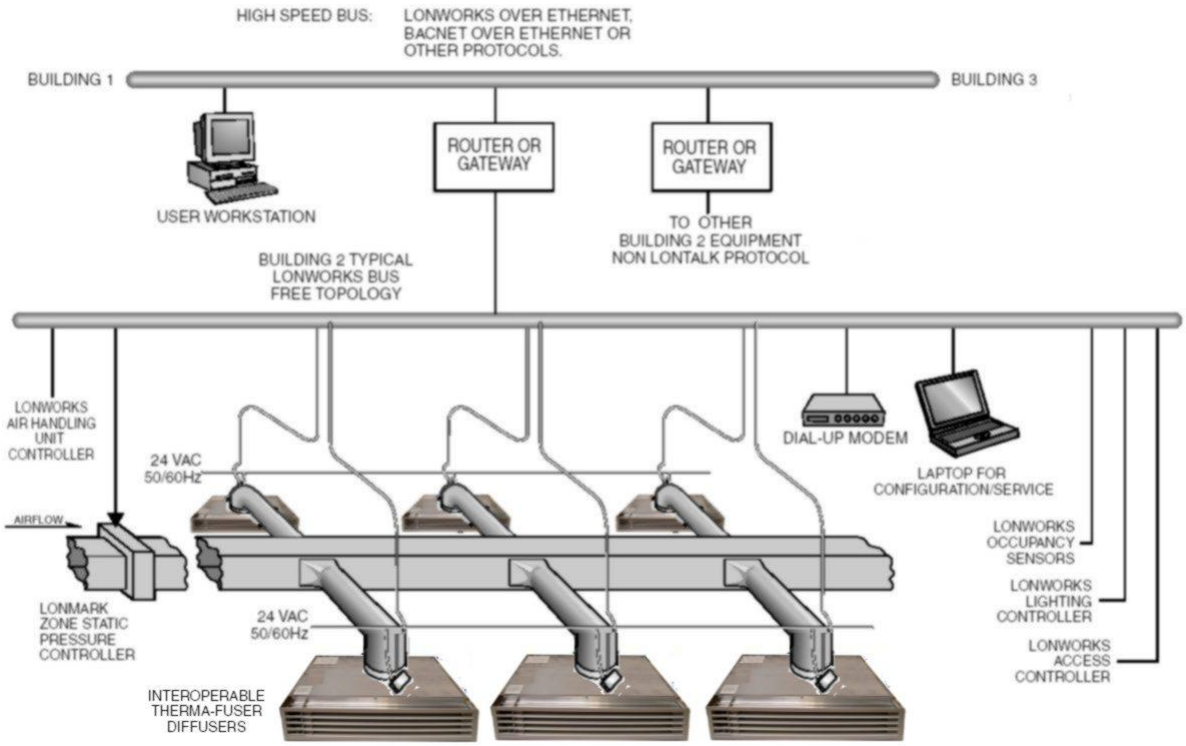
THE ELW INTEROPERABLE
THERMA-FUSER™
SIDEWALL LINEAR VAV DIFFUSER

THERMA-FUSER DIFFUSERS IN AN INTEROPERABLE DDC SYSTEM



SPECIFICALLY DESIGNED FOR INTEROPERABILITY

The ELW provides more information about what's happening in the space than any other VAV terminal because it monitors load, supply air temperature and flow at each diffuser. LonMark® compatible, the ELW will exchange data with products from other vendors on any LonWorks® DDC building control network. Interoperability with other control networks is easy using gateways by other manufacturers.

BETTER CONTROL – ADAPTIVE ARTIFICIAL INTELLIGENCE

Adaptive artificial intelligence enables the ELW to learn the dynamics of any room. During operation the unit continuously updates its control process to give the correct control response. This eliminates field tuning and calibration required by most controllers. It also eliminates inaccuracies seen when room conditions stray from tuned conditions. Adaptive control compensates for mechanical hysteresis too.

ONLY THERMA-FUSER™ VAV OFFERS THESE BENEFITS

- Superior air distribution – longer throws, no dumping, more entrainment, even temperature distribution, higher ADPI and better ventilation effectiveness.
- Lowest cost per DDC zone of control.
- Lowest energy DDC VAV terminal – green VAV.
- Low to no maintenance.
- Easily adapts to office changes.

NETWORK AND CONFIGURATION VARIABLES

For ease of interoperability the ELW uses standard variables similar to the VAV Controller Functional Profile ID:8010 published by the LonMark® Interoperability Association. It utilizes the following variables.

CONFIGURATION

Occupancy Temperature Setpoints – Heating and cooling temperature setpoints for various occupancy modes.

Location Label or Description – Used to provide a descriptive physical location (such as room number).

VAV heating/VAV cooling or VAV cooling only.

Other configuration properties include send heartbeat, maximum receive time and maximum send time.

INPUTS

Temperature Setpoint – Can be changed via the network.

Application Mode – Change to another mode such as night purge or morning warm up.

Manual Override – Can be used to open for balancing.

Occupancy Command – Occupied or Unoccupied.

Emergency Command – Pressurize or Depressurize.

Other inputs include space temperature, flow, energy hold off, CO_2 sensor, duct inlet temperature and setpoint offset.

OUTPUTS

Air Flow Rate.

Space Temperature.

Supply Air Temperature

Unit Status – Combines the operating mode, the capacity of heating and cooling used and an indication of any alarms present.

Effective Setpoint – Reports effective setpoint when the setpoint is changed locally.

Terminal Load – Energy use as a function of percentage of maximum flow setting and supply air temperature.

One Slot Sidewall

Model	Inlet Static Pressure In. wg	Maximum Flow cfm	Maximum Flow Throw - Feet* @v_t=50/100/150FPM	Maximum Flow NC	25% Maximum Flow Throw - Feet* @v_t=50/100/150FPM	25% Maximum Flow NC
TLW-2411	.05	45	4/3/2	<15	1/–/–	<15
	.10	60	5/4/4	<15	1/–/–	<15
	•.15	70	5/4/4	21	2/1/1	<15
	.20	80	6/5/4	24	3/2/1	<15
	.25	90	7/6/5	27	4/3/2	21
TLW-3611	.05	70	4/3/2	<15	1/–/–	<15
	.10	90	5/4/4	19	1/–/–	<15
	•.15	110	5/4/4	22	2/1/1	<15
	.20	125	7/6/5	25	3/2/1	<15
	.25	140	7/6/5	28	4/3/2	21
TLW-4811	.05	90	4/3/3	<15	1/–/–	<15
	.10	125	5/4/3	21	2/1/1	<15
	•.15	150	6/5/4	25	3/2/2	<15
	.20	175	7/6/5	28	4/3/2	21
	.25	190	8/7/6	31	4/3/2	24
TLW-6011	.05	100	4/3/3	<15	1/–/–	<15
	.10	150	5/4/4	22	1/–/–	<15
	•.15	180	7/6/5	26	2/1/–	20
	.20	210	7/6/5	29	2/1/–	22
	.25	230	8/6/5	32	3/2/2	25

Two Slot Sidewall

Model	Inlet Static Pressure In. wg	Maximum Flow cfm	Maximum Flow Throw - Feet* @v_t=50/100/150FPM	Maximum Flow NC	25% Maximum Flow Throw - Feet* @v_t=50/100/150FPM	25% Maximum Flow NC
TLW-2421	.05	65	4/3/3	<15	1/–/–	<15
	.10	90	5/4/4	19	1/–/–	<15
	•.15	110	6/5/4	23	2/1/–	19
	.20	130	7/6/5	29	3/2/1	22
	.25	145	7/6/5	31	4/3/2	25
TLW-3621	.05	85	3/2/2	<15	1/–/–	<15
	.10	120	4/3/3	22	1/–/–	<15
	•.15	145	5/4/4	24	2/1/–	21
	.20	165	6/5/4	29	2/1/1	26
	.25	180	7/6/5	31	3/2/2	29
TLW-4821	.05	150	7/6/5	<15	2/1/–	<15
	.10	200	8/7/6	22	2/1/–	<15
	•.15	240	9/8/7	26	3/2/.05	22
	.20	280	10/9/8	30	4/3/2	23
	.25	310	10/9/8	32	6/4/3	27
TLW-6021	.05	170	5/4/3	<15	2/1/–	<15
	.10	230	7/6/5	23	2/1/–	<15
	•.15	280	8/7/6	27	3/2/–	24
	.20	320	9/8/6	30	3/2/2	27
	.25	360	10/8/7	32	5/3/2	31

Four Slot Sidewall

Model	Inlet Static Pressure In. wg	Maximum Flow cfm	Maximum Flow Throw - Feet* @v_t=50/100/150FPM	Maximum Flow NC	25% Maximum Flow Throw - Feet* @v_t=50/100/150FPM	25% Maximum Flow NC
TLW-2441	.05	150	4/3/3	<15	1/–/–	<15
	.10	210	7/6/5	25	2/1/–	19
	•.15	260	8/7/6	27	3/2/1	22
	.20	300	8/7/6	32	4/3/2	27
	.25	335	9/8/7	35	4/3/2	31
TLW-3641	.05	180	4/3/3	<15	1/–/–	<15
	.10	250	6/5/4	25	2/1/–	19
	•.15	310	7/6/5	28	2/1/1	23
	.20	360	8/7/6	32	3/2/1	28
	.25	400	8/7/6	35	4/3/2	31
TLW-4841	.05	315	9/7/6	<15	2/1/–	<15
	.10	445	11/9/7	26	2/1/1	22
	•.15	545	11/9/7	32	3/2/2	27
	.20	630	13/11/9	35	5/4/3	32
	.25	700	14/12/10	39	6/5/4	35
TLW-6041	.05	400	11/9/7	<15	2/1/–	<15
	.10	570	13/11/9	27	2/1/1	22
	•.15	700	13/11/9	32	4/3/2	27
	.20	800	15/12/10	36	6/5/4	32
	.25	900	17/15/12	39	7/6/5	34

• Denotes nominal rating. NC based on $L_W(10^{-12}$ watts reference)–10db

* Throw data is for air 20°F/11°C lower than room temperature. Throws for isothermal air are 40–50% greater. Tested in accordance with ANSI/ASHRAE 70-1991, ANSI S12.31, ARI 890-2001, ISO 5219 and ISO 3741.

THE ELW INTEROPERABLE THERMA-FUSER LINEAR VAV DIFFUSER

HOW IT WORKS

The ELW Therma-Fuser linear diffuser has blade damper(s) that open and close to meter air flow (hot or cold) into the room. The damper(s) are modulated by the piston of a thermal actuator.

Thermal actuators, used for reliability and low maintenance, have a piston in a cylinder wrapped with a resistance heater. The cylinder is filled with petroleum wax which, when heated by the resistance heater, expands to push out the piston. When heat is stopped the wax rapidly cools and contracts and the piston retracts.

The thermal actuator piston is precisely positioned with a variable DC signal to the resistance heater form the DDC controller.

The DDC controller with adaptive artificial intelligence has the ability to learn form experience and modify control behavior similar to the reasoning power of the human brain. This adaptive controller controls to setpoint in response to room temperature, supply air temperature and flow.

Every 10 seconds it determines if the flow should be adjusted and the amount of any adjustment based on temperature relationships and both the rate and direction of change of flow.

SELECTION GUIDELINES

Minimum/Maximum Spacing – Use the throw ratings for design air volume (maximum flow in the Performance Guide) to determine distances for minimum and maximum spacing to walls and other diffusers. Below design air volume, room air motion will be kept to acceptable levels by the increasing entrainment ratio as the diffuser turns down.

Less than 100fpm / 0.51m/s (interpolate) is normally satisfactory for air discharged against an inside partition and up to 150fpm / 0.76m/s can be tolerated against an outside wall. Maximum throw is usually figured around the 50fpm / 0.25m/s point.

DISTANCE BELOW THE CEILING

Ratings in the Performance Guide are for sidewall diffusers installed with the top edge 2 in./10mm or less below the ceiling.

Under these conditions, the distance between the bottom of the 50fpm/.025m/s lobe and the horizontal centerline of the diffuser face is 4 in./100mm for one slot diffuser, 5 in./125mm for two slot diffusers and 10 in./250mm for four slot diffusers. The drops remain the same for installations with the top edge of the diffuser more than 2 in./100mm below the ceiling.

Throw reduces as the distance increases between the ceiling and the top edge of the diffuser as show in the following graph.

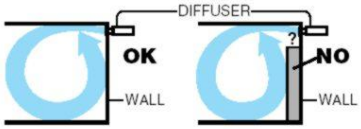
The volume of induction air (into the plenum) required in addition to rated air volume is:

Inlet SP In. wg/Pa	1 and 2 Slots CFM/L/s	4 Slot CFM/L/s
.05 / 12	7 / 3.3	11 / 5.2
.10 / 25	9 / 4.2	14 / 6.6
.15 / 37	11 / 5.2	17 / 8.0
.20 / 50	12.5 / 5.9	20 / 9.4
.25 / 62	14 / 6.6	22 / 10.4

When given a choice, put diffusers in line with one another, not blowing at each other. But when they must, space diffusers at least two times the 150fpm / 0.76m/s throw (preferably two times the 100fpm / 0.51m/s throw) to avoid down drafts.

Maximum centerline spacing between diffusers in line (in the same row) should be three to four times the unit's length. A 48in. / 1200mm diffuser would then cover an area 12 to 16 feet / 3650 to 4875 mm wide (maximum).

Do not obstruct the venturi outlet at the end of the diffuser. Allow a spacing of 2in. / 50mm or more between the venturi opening at the end of the diffuser and lights, joists, other diffusers, etc.



Return Air may be handled in the conventional manner using return air grills or, more typically, return air sidewall slots can be provided to match the supply air diffusers.

Each space should have returns. Select returns with the same total length of slot as the supply air diffuser in the space. If return air slots must be located in the supply air stream, place them beyond the 50fpm / 0.25m/s throw for the supply air diffuser.

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SYSTEM DESIGN

The best control for heating/cooling air handling units supplying air to VAV terminals is a discharge sensor or thermostat which maintains constant supply air temperature. With DX equipment these are a high and low limit. The fan should run continuously.

The constant discharge velocity of Therma-Fuser diffusers at varying air flow provides good room circulation which reduces stratification.

Because the Therma-Fuser diffusers control room temperature by sensing room air induced up the wall, care should be taken not to disturb room air induction and entrainment. Avoid the possibility of anything, including furniture, below the diffuser which blocks secondary air from entering the induction chamber of the diffuser.

Keeping heating supply air temperatures as low as possible will further reduce room air stratification to a negligible level.

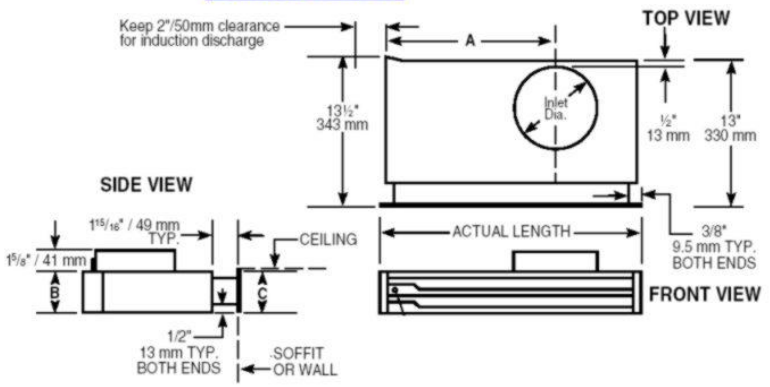
Static pressure at the inlet of the Therma-Fuser diffuser should be between 0.05"wg / 12Pa and 0.25"wg / 62Pa at full and partial air flows. Static pressure below 0.05"wg / 12Pa will result in low air flow and less induction. Above 0.25"wg / 62Pa, Therma-Fuser diffusers operate well but excessive noise may result.

If the system turns down more than 30%, static pressure should be controlled. Included in the options for static pressure control are fan control and bypass dampers. Zone dampers are recommended where several zones share a higher pressure duct or riser.

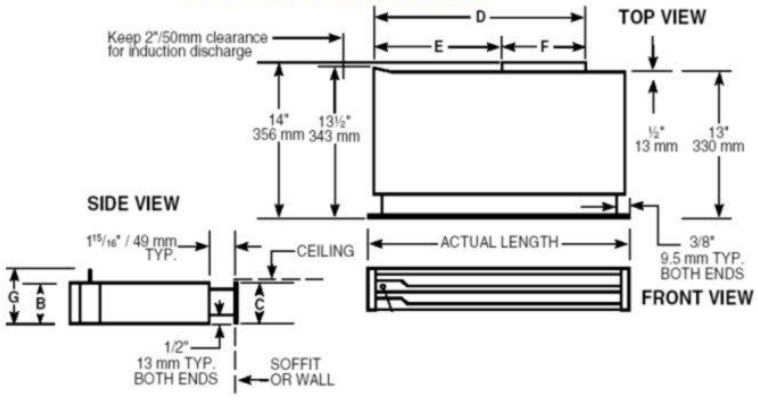
When designing ducts, if Therma-Fuser diffusers are to deliver nominal volume at an inlet static pressure of 0.15"wg / 37Pa and if a maximum static pressure of 0.25"wg / 62Pa is to be held for quiet operation, size the duct for a maximum pressure drop of 0.10"wg / 25Pa between the first and last takeoff.

DIMENSIONS

TOP ROUND INLET



REAR RECTANGULAR INLET



ONE AND TWO SLOT

Nominal Length	Actual Length	Round Inlet Dia.	Optional Rectangular Inlet	A	B	C		D	E	F	G
						1 Slot	2 Slot				
24 (2411, 2421)	23¾ in. 603mm	5⅞ in. 150mm	4 x 8 in. 102 x 203mm	15 1/16 in. 383mm	4 in. 102mm	2 9/16 in. 65mm	3¾ in. 95mm	19¾ in. 502mm	11¾ in. 298mm	8 in. 203mm	4⅝ in. 118mm
36 (3611, (3621)	35¾ in. 908mm	5⅞ in. 150mm	4 x 8 in. 102 x 203 mm	21 1/16 in. 535mm	4 in. 102mm	2 9/16 in. 65mm	3¾ in. 95mm	26⅞ in. 683mm	18⅞ in. 479mm	8 in. 203mm	4⅝ in. 118mm
48 (4811, 4821)	47¾ in. 1213mm	7⅞ in. 200mm	4 x 16 in. 102 x 406mm	28 1/16 in. 713mm	4 in. 102mm	2 9/16 in. 65mm	3¾ in. 95mm	36⅞ in. 937mm	20⅞ in. 530mm	16 in. 406mm	4⅝ in. 118mm
60 (6011, 6021)	59¾ in. 1518mm	7⅞ in. 200mm	4 x 16 in. 102 x 406 mm	34 1/16 in. 865mm	4 in. 102mm	2 9/16 in. 65mm	3¾ in. 95mm	36⅞ in. 937mm	20⅞ in. 530mm	16 in. 406mm	4⅝ in. 118mm

FOUR SLOT

Nominal Length	Actual Length	Round Inlet Dia.	Optional Rectangular Inlet	A	B	C	D	E	F	G
24 (2441)	23¾ in. 603mm	7⅞ in. 200mm	6 x 10 in. 152 x 254mm	16 1/16 in. 408mm	6 in. 152mm	6 in. 152mm	21¾ in. 552mm	11¾ in. 298mm	10 in. 254mm	6⅝ in. 168mm
36 (2641)	35¾ in. 908mm	7⅞ in. 200mm	6 x 10 in. 152 x 254mm	22 1/16 in. 560mm	6 in. 152mm	6 in. 152mm	26⅞ in. 683mm	16⅞ in. 429mm	10 in. 254mm	6⅝ in. 168mm
48 (4841)	47¾ in. 1213mm	9⅞ in. 250mm	6 x 18 in. 152 x 457nn	29 1/16 in. 738mm	6 in. 152mm	6 in. 152mm	38⅞ in. 987mm	20⅞ in. 530mm	18 in. 457mm	6⅝ in. 168mm
60 (6041)	59¾ in. 1518mm	11⅞ in.† 300mm†	6 x 18 in. 152 x 457mm	37 1/16 in. 926mm	6 in. 152mm	6 in. 152mm	38⅞ in. 987mm	20⅞ in. 530mm	18 in. 457mm	6⅝ in. 168mm

† Oval shaped inlet

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A short length of low pressure flexible duct should be used to connect the diffuser. To avoid static pressure losses, flexible duct runs should be designed and installed as straight as possible (equivalent of one 90° turn maximum). Flexible duct connections to all diffusers must provide a straight run of four duct diameters minimum leading to the inlet to help insure effective operation.

Acutherm has "how to" system design brochures for almost every ducted air system.

GUIDE SPECIFICATION

Interoperable variable air volume linear diffusers shall be Therma-Fuser model ELW manufactured by Acutherm, Hayward, CA. Each diffuser shall be a complete VAV terminal with room air thermostat, supply air thermostat, flow sensor(s), adaptive controller, and thermal actuator self-contained in a linear diffuser. They shall be LonMark® compatible for interoperability on any LonWorks® network.

The adaptive controller shall have the ability to learn the dynamics of the conditioned space and change control response as the space changes. P, PI, PD and PID control shall not be acceptable.

The controller shall be compatible with the LonMark® Functional Profile for VAV controllers. It shall provide most network and configuration variables (except the inapplicable internal heater and internal fan control options).

The diffuser blades shall be constructed of extruded aluminum with all visible portions painted T-Bar off white low-gloss enamel. The diffuser shall be complete with plenum constructed of 24 gauge galvanized steel.

The diffuser shall have an induction chamber and supply air venturi at one end for inducing room air past the room temperature sensor. The venturi shall be at least 4in. / 100mm wide for effective induction. The VAV diffuser shall have positive induction of secondary room air over the room thermostat at all flows from fully closed to fully open.

Manufacturer's ratings for flow and sound shall be verified by an independent testing laboratory certified for ARI 890 and ADC testing.

Power compression springs cartridges shall be attached directly to the thermal actuator to contain the forces produced without distorting other parts of the diffuser and assure accuracy of control.

Optional – The diffuser shall be lined with ½" 2 pound density black bonded blanket of glass fibers with smooth fire resistant air stream surfaces adhered with ASTM C 916 adhesive.

Power Requirements:	24VAC +4/-2VAC. 18VA maximum.
Processor:	Echelon 3150
Transceiver:	Free Topology FTT-10
Terminations:	Network: RJ 45 or screw terminals. Power: Screw terminals.
Operating Environment:	Temperature: -13°F/25°C to 131°F/55°C. Humidity: 5-95% relative humidity, non-condensing.
Indicators:	LED indicators for power and network communications.

TWO YEAR WARRANTY

Acutherm warrants that its ELW Therma-Fuser linear diffusers, exclusive of any options and accessories (whether factory or field installed) shall be free from defective material or workmanship for a period of two (2) years from the date of shipment and agrees to repair or replace, at its option, any parts that fail during said two (2) year period due to any such defects which would not have occurred had reasonable care and proper usage and all parts and controls remain unaltered. Acutherm makes NO WARRANTY OF MERCHANTABILITY OF PRODUCTS OR OF THEIR FITNESS FOR ANY PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY WHICH EXTENDS BEYOND THE LIMITED WARRANTY ABOVE. ACUTHERM'S LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM DEFECTS SHALL IN NO EVENT EXCEED THE COST OF REPAIR OR REPLACEMENT OF PARTS FOUND DEFECTIVE UPON EXAMINATION BY ACUTHERM. IN NO EVENT SHALL ACUTHERM BE LIABLE FOR INCIDENTAL, INDIRECT OR CONSEQUENTIONAL DAMAGES OR DAMAGES FOR INJURY TO PERSONS OR PROPERTY. Acutherm shall not be responsible for freight to or from its plant in connection with the inspection, repair or replacement of parts under the terms of this limited warranty nor for cost of removal or installation.

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