



# MSP Turbo™ Liquid Flow Controller

Model 2950-V



**Designed specifically for leading edge microelectronic applications, this highly accurate, high-speed liquid flow controller features an embedded precision flow control valve. The 2950-V pairs with MSP Turbo™ Vaporizers which do not have the on-board piezo liquid control valve to provide unmatched liquid source vapor delivery performance, versatility, and longevity.**

Model Number	2950-V
Turndown Ratio <sup>[2]</sup>	30:1
Max Viscosity (cp) <sup>[3]</sup>	10
Accuracy % F.S. <sup>[4]</sup>	±1.0
Repeatability % F.S. <sup>[4]</sup>	±0.4
Linearity % F.S. <sup>[4]</sup>	±0.6
Response time(s) <sup>[5]</sup>	≤0.5 to ±1% S.P.
Environmental Temperature (°C)	15-45; 0-80% RH
Liquid Temperature (°C) <sup>[6]</sup>	15-35, 100% F.S. 35-40, <80% F.S.
Temperature Sensitivity (% F.S.) <sup>[7]</sup>	±0.05/°C
Max Pressure Drop (kPa/psig) <sup>[8]</sup>	90/13
Max Operating Pressure (kPa/psig) <sup>[2]</sup>	360/52
Leak Integrity (Pa m <sup>3</sup> /s, He)	≤ 1 × 10 <sup>-10</sup>
Power	+10-30VDC;
Typical	1.0W (w/o EtherCAT) 1.5W (w/ EtherCAT)
Max.	15W
Wetted Materials	316SS, Nickel, FFKM, BNI-5
Fittings (Inlet & Exit)	
Inlet	1/8" VCR male
Exit	1/8" VCR male
Interface	
EtherCAT <sup>[8]</sup>	2xRJ45
RS485	9-pin D connector (male)
Analog	9-pin D connector (male)
Software communication via RS485	
3 Output Control Signals	
	1 Fixed, 1-130V (for Piezo Control)
	2 Configurable
	3 Options: 0-5V, 0-10V, 4-20mA, 1-5V, 2-10V, 0-20mA
	Configurable Options: 0-5V, 0-10V

## 1 Analog Input

[1] Nominal max flow determined using TEOS as reference liquid at 23±2°C. Flow rate range is a function of specified liquid.  
 [2] Determined using TEOS as reference liquid at 23±2°C.  
 [3] Higher viscosities will result in lower max flow ranges. Consult MSP for more information on use at higher viscosities.  
 [4] Accuracy, repeatability, and linearity tested to SEMI E56-0317 using TEOS at 23±2°C.  
 [5] Response time determined using TEOS as reference liquid at 23±2°C, when paired with MSP "PE" Turbo-Vaporizer™, full scale flow, optimized PID, ≥45psi line pressure. Specification applies to all models except 2950-002, which has a response time 2-3 times slower due to the extremely low flow rate.  
 [6] If the liquid temperature goes above 35°C, the full scale is reduced to 80% of nominal.  
 [7] For every 1°C away from 23°C, accuracy can be degraded ±0.05%.  
 [8] Pressure drop in device - not including downstream valves, 23 ± 2°C.  
 [9] ETG.5003.2020 S (R) V1.1.0 compatible.

## Nominal Max Flow (g/min) <sup>[1]</sup>

Model Number	TEOS Full Scale (g/min)	TEMAZr Full Scale (g/min)	H <sub>2</sub> O Full Scale (g/min)
2950-002V	0.2	N/A	0.14
2950-01V	1	0.19	0.73
2950-05V	5	0.95	3.6
2950-10V	10	1.9	7.3
2950-20V	20	3.8	14
2950-30V	30	5.7	21

## Other Liquids

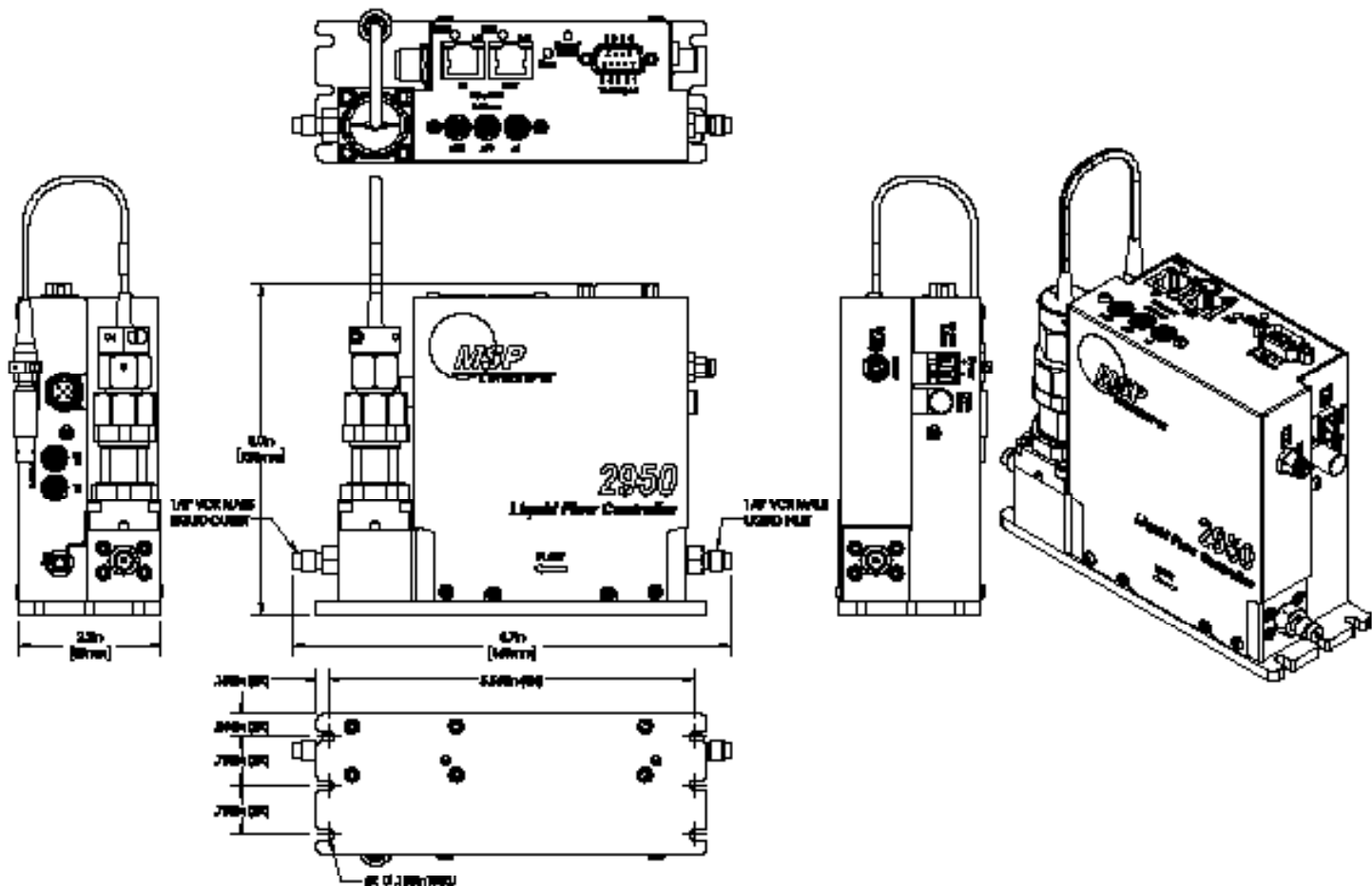
The full scale (F.S.) of the 2950 LFC is a function of liquid viscosity ( $\mu_{\text{liquid(cP)}}$ ). To estimate the full scale (F.S.) of each model for your liquid, use the equation below:

If $\mu_{\text{liquid(cP)}} \geq 0.65$	If $\mu_{\text{liquid(cP)}} < 0.65$
$F.S._{\text{Other Liquid}} = F.S._{\text{TEOS}} * \frac{0.65 \text{ cP}}{\mu_{\text{liquid(cP)}}}$	$F.S._{\text{Other Liquid}} = F.S._{\text{TEOS}} * \frac{\mu_{\text{liquid(cP)}}}{0.65 \text{ cP}}$

## Factory Calibration

TEOS used for factory calibration. For use with other liquids a factory calibration adjustment or field calibration with reference flow meter can be performed using 2950 Configuration Software. Factory calibration for other liquids may be possible. Visit [www.tsi.com/](http://www.tsi.com/) contact to request more information.

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All specifications are subject to change without notification.

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