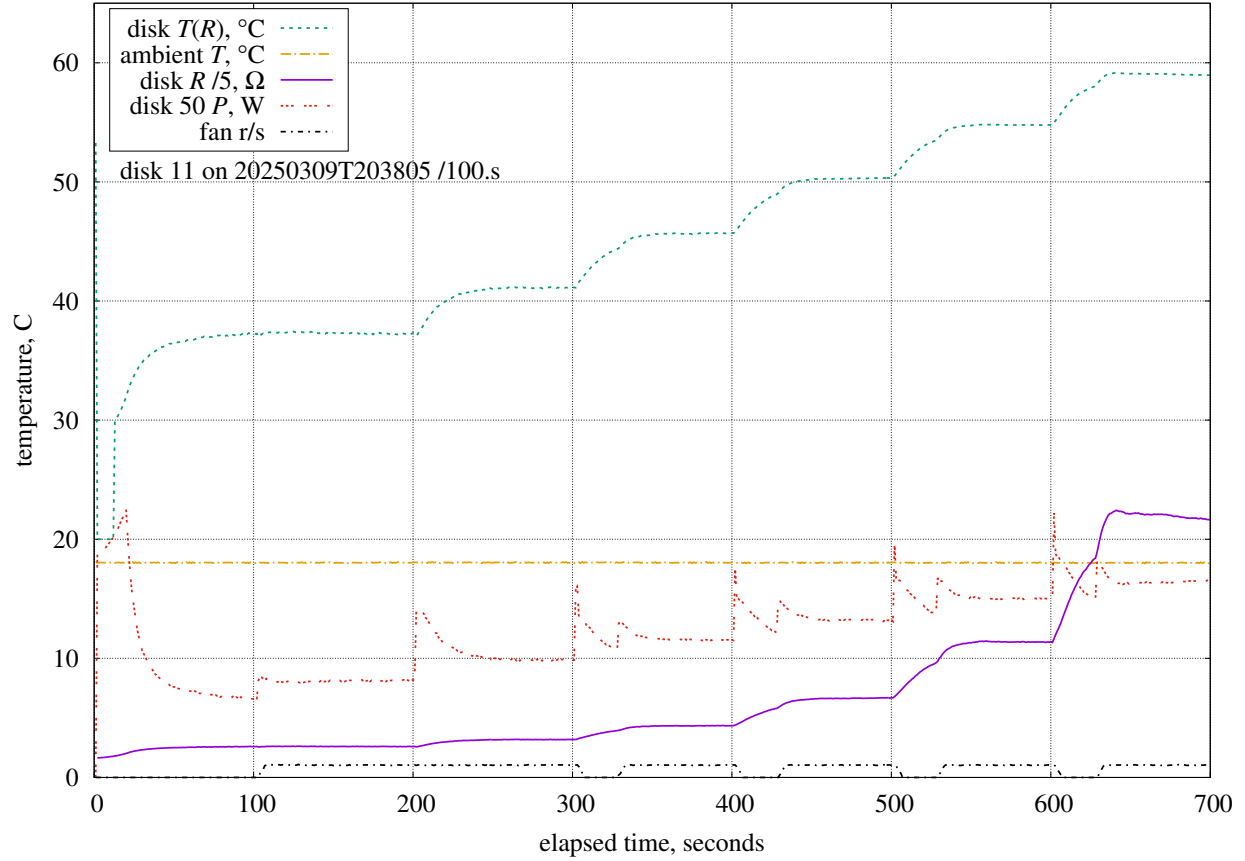


$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 0.000$  m/s (0 r/min)

Estimated measurement uncertainties of natural convection at  $\theta = 0.0$ .

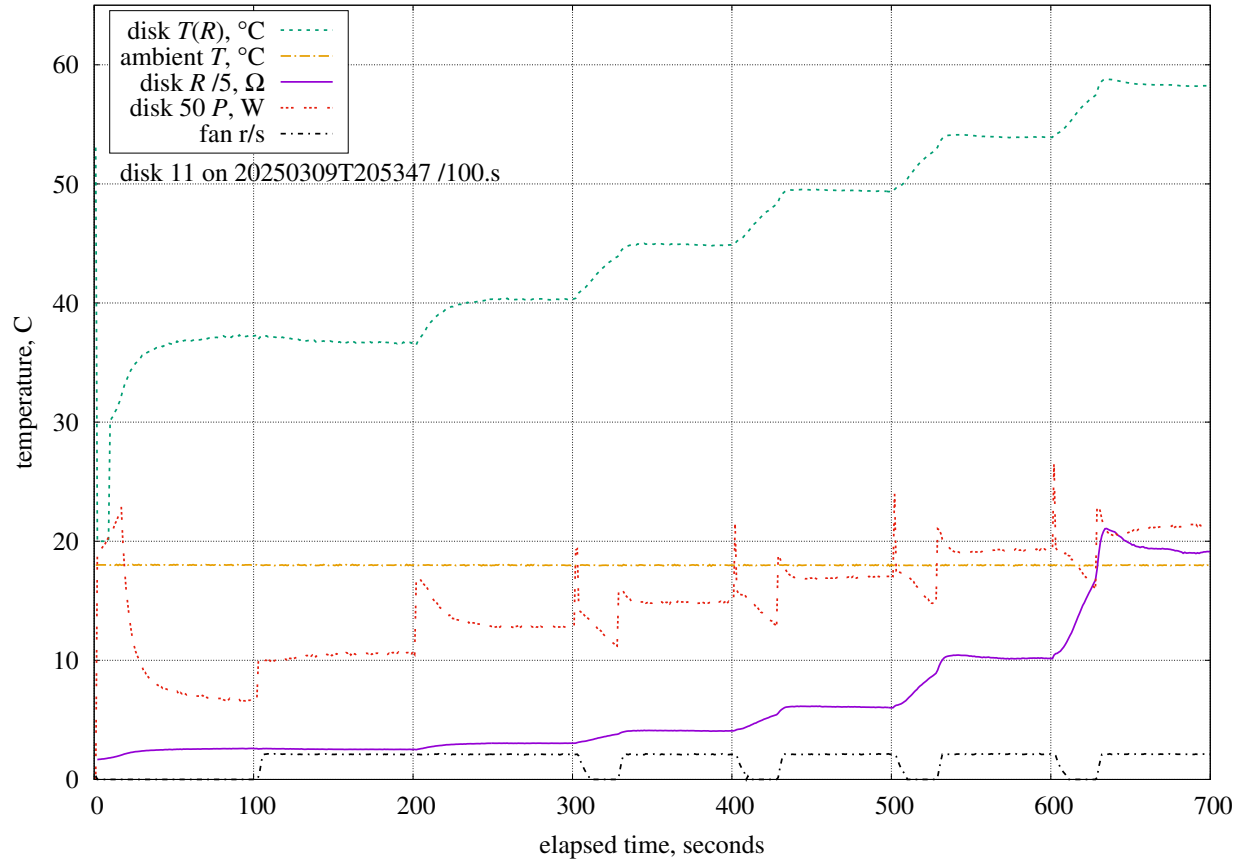
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+4.34%/K	0.10.K	0.43%	LM35C differential
$P$	99.6.kPa	+0.0002%/Pa	1.5.kPa	0.29%	MPXH6115A6U air pressure
$D_o$	2.81.mm	+2790%/m	500.um	1.40%	tube outer diameter
$D_i$	1.11.mm	+4830%/m	200.um	0.97%	tube inner diameter
$L_{\text{wire}}$	38.0.mm	+979%/m	500.um	0.49%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.117%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.05%	ABS thermal conductivity
$d$	12.0.mm	+5242%/m	100.um	0.52%	disk diameter
$\theta$	50.0.m°	+21.5%/°	0.20.°	4.30%	plate angle
				4.82%	combined bias uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 0.188 \text{ m/s}$  (62 r/min)

Estimated measurement uncertainties at  $Re = 138$ .

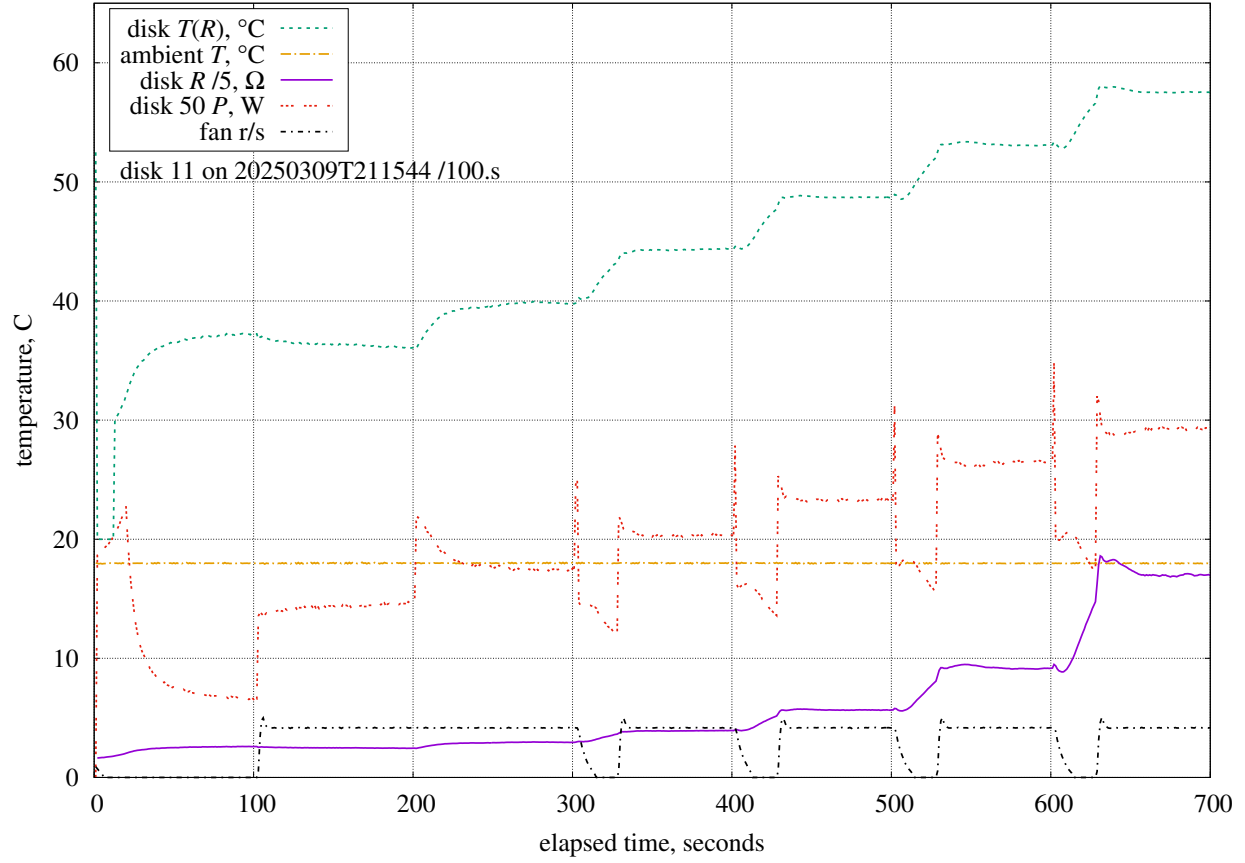
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	-0.410%/K	0.50.K	0.20%	LM35C temperature sensor
$\Delta T$	25.0.K	+4.12%/K	0.10.K	0.41%	LM35C differential
$P$	99.5.kPa	+0.0005%/Pa	1.5.kPa	0.75%	MPXH6115A6U air pressure
$\eta$	0.340	+115%	0.007	0.78%	anemometer calibration
$Re_0$	600	-0.0053%	60	0.32%	integration lower-bound
$D_o$	2.81.mm	-7276%/m	500.um	3.64%	tube outer diameter
$D_i$	1.11.mm	+9092%/m	200.um	1.82%	tube inner diameter
$L_{\text{wire}}$	38.0.mm	+884%/m	500.um	0.44%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.141%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.26%	ABS thermal conductivity
$d$	12.0.mm	+6158%/m	100.um	0.62%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-40.0%	0.010	0.40%	ABS emissivity
$\epsilon_{\text{wt}}$	0.900	-40.3%	0.025	1.01%	wind-tunnel emissivity
$\theta$	50.0.m°	-2.82%/°	0.20.°	0.56%	plate angle
$\psi$	50.0.m°	+1.03%/°	0.25.°	0.26%	flow angle
				4.67%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	62.3.r/min	+0.628%/(r/min)	0.94.r/min	0.59%	fan rotation rate
				4.82%	RSS combined uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 0.381 \text{ m/s}$  (126 r/min)

Estimated measurement uncertainties at  $Re = 280$ .

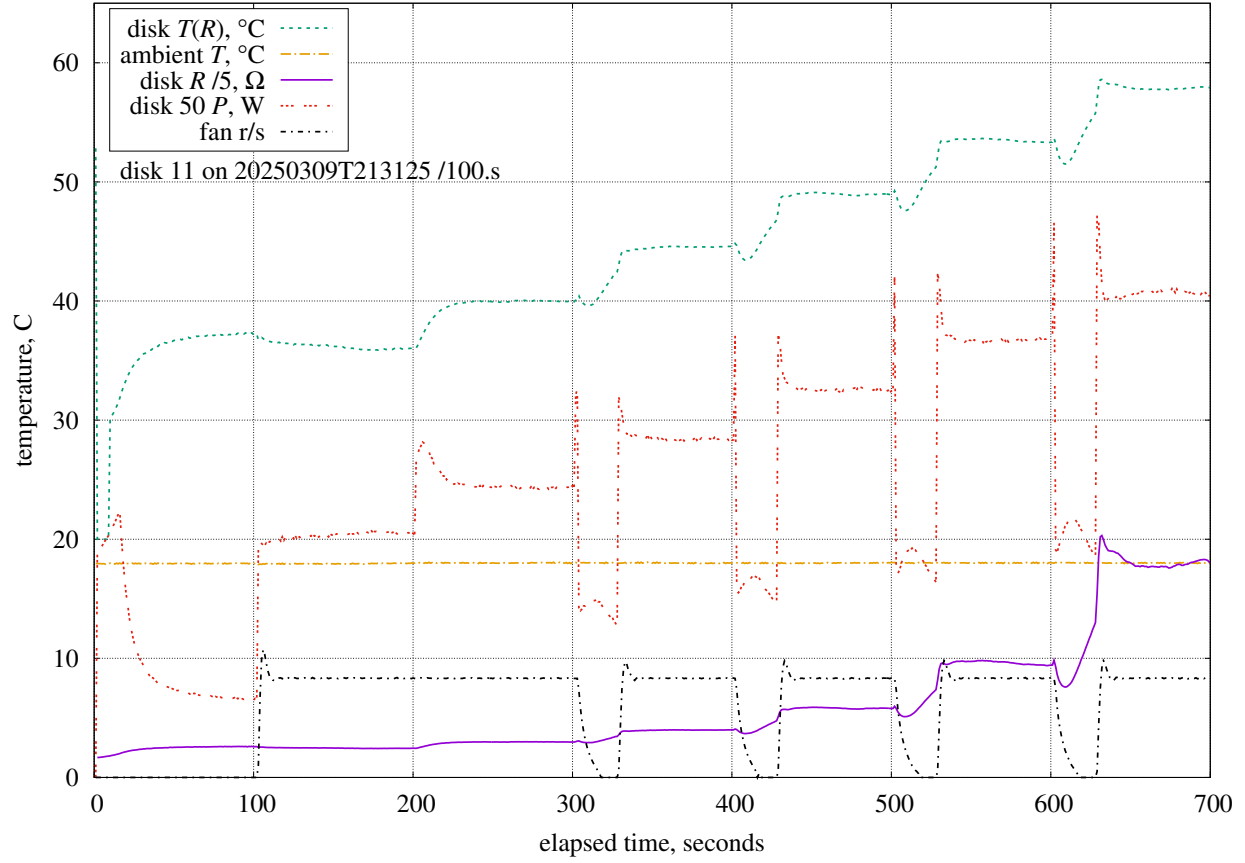
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	$-0.483\%/K$	0.50.K	0.24%	LM35C temperature sensor
$\Delta T$	25.0.K	$+3.96\%/K$	0.10.K	0.40%	LM35C differential
$P$	99.5.kPa	$+0.0005\%/Pa$	1.5.kPa	0.78%	MPXH6115A6U air pressure
$\eta$	0.340	$+132\%$	0.007	0.90%	anemometer calibration
$Re_0$	600	$-0.0074\%$	60	0.44%	integration lower-bound
$D_o$	2.81.mm	$-11099\%/m$	500.um	5.55%	tube outer diameter
$D_i$	1.11.mm	$+14280\%/m$	200.um	2.86%	tube inner diameter
$D_g$	166.um	$-335\%/m$	750.um	0.25%	tube air gap
$L_{\text{wire}}$	38.0.mm	$+1397\%/m$	500.um	0.70%	wire length
$k_{\text{ABS}}$	$179. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$+0.177\%/ \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$9.0. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.59%	ABS thermal conductivity
$d$	12.0.mm	$+5626\%/m$	100.um	0.56%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	$-46.9\%$	0.010	0.47%	ABS emissivity
$\epsilon_{wt}$	0.900	$-47.5\%$	0.025	1.19%	wind-tunnel emissivity
$\theta$	$50.0.\text{m}^\circ$	$-4.88\%/^\circ$	$0.20.^\circ$	0.98%	plate angle
$\psi$	$50.0.\text{m}^\circ$	$+1.00\%/^\circ$	$0.25.^\circ$	0.25%	flow angle
				6.84%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	126.r/min	$+0.356\%/(r/min)$	0.96.r/min	0.34%	fan rotation rate
				6.88%	RSS combined uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 0.748 \text{ m/s}$  (250 r/min)

Estimated measurement uncertainties at  $Re = 551$ .

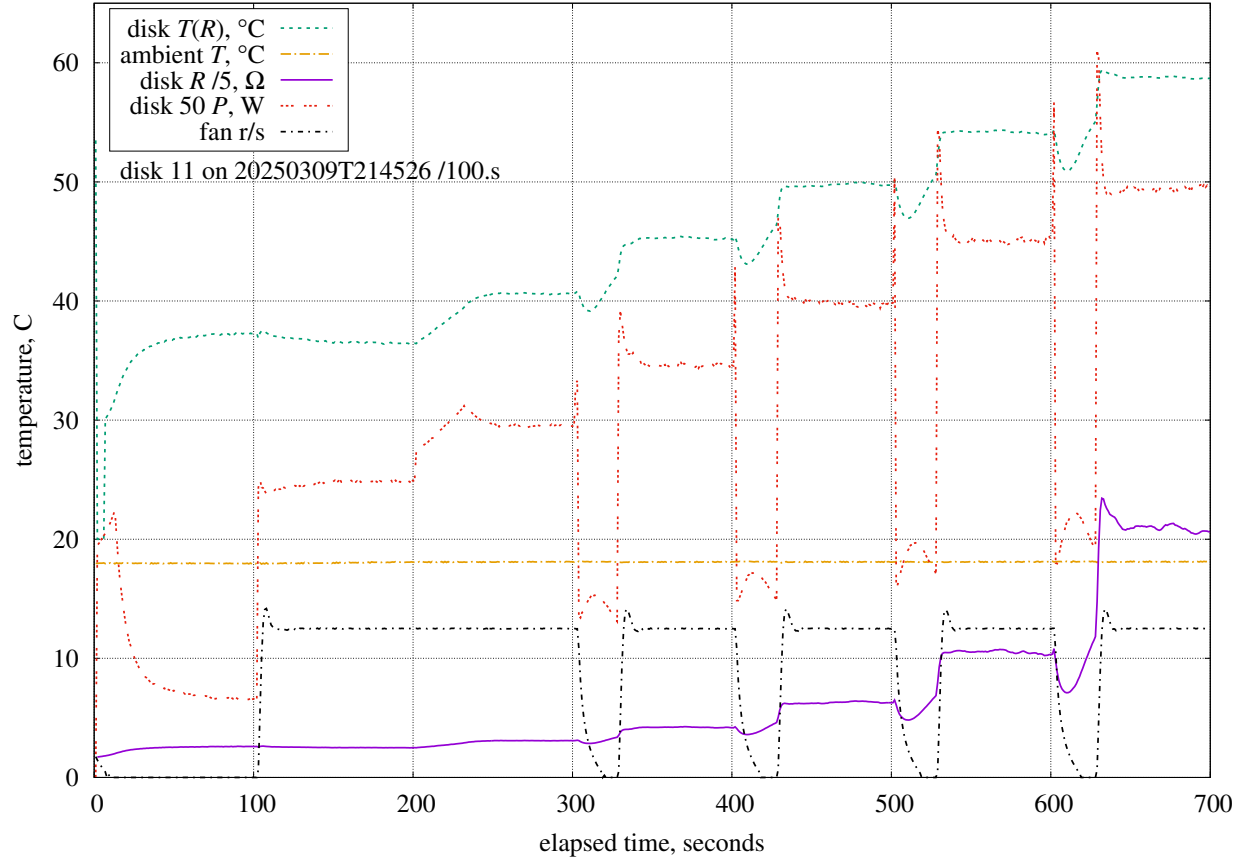
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	$-0.507\%/K$	0.50.K	0.25%	LM35C temperature sensor
$\Delta T$	25.0.K	$+3.80\%/K$	0.10.K	0.38%	LM35C differential
$P$	99.6.kPa	$+0.0005\%/Pa$	1.5.kPa	0.76%	MPXH6115A6U air pressure
$\eta$	0.340	$+134\%$	0.007	0.91%	anemometer calibration
$Re_0$	600	$-0.0091\%$	60	0.54%	integration lower-bound
$D_o$	2.81.mm	$-14416\%/m$	500.um	7.21%	tube outer diameter
$D_i$	1.11.mm	$+18972\%/m$	200.um	3.79%	tube inner diameter
$D_g$	166.um	$-482\%/m$	750.um	0.36%	tube air gap
$L_{\text{wire}}$	38.0.mm	$+2009\%/m$	500.um	1.00%	wire length
$k_{\text{ABS}}$	$179. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$+0.205\%/ \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$9.0. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.83%	ABS thermal conductivity
$d$	12.0.mm	$+5442\%/m$	100.um	0.54%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	$-48.9\%$	0.010	0.49%	ABS emissivity
$\epsilon_{wt}$	0.900	$-49.7\%$	0.025	1.24%	wind-tunnel emissivity
$\theta$	$50.0.m^\circ$	$-4.40\%/^\circ$	$0.20.^\circ$	0.88%	plate angle
$\psi$	$50.0.m^\circ$	$+0.848\%/^\circ$	$0.25.^\circ$	0.21%	flow angle
				8.70%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	250.r/min	$+0.182\%/(r/min)$	1.0.r/min	0.19%	fan rotation rate
				8.71%	RSS combined uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 1.466 \text{ m/s}$  (500 r/min)

Estimated measurement uncertainties at  $Re = 1080$ .

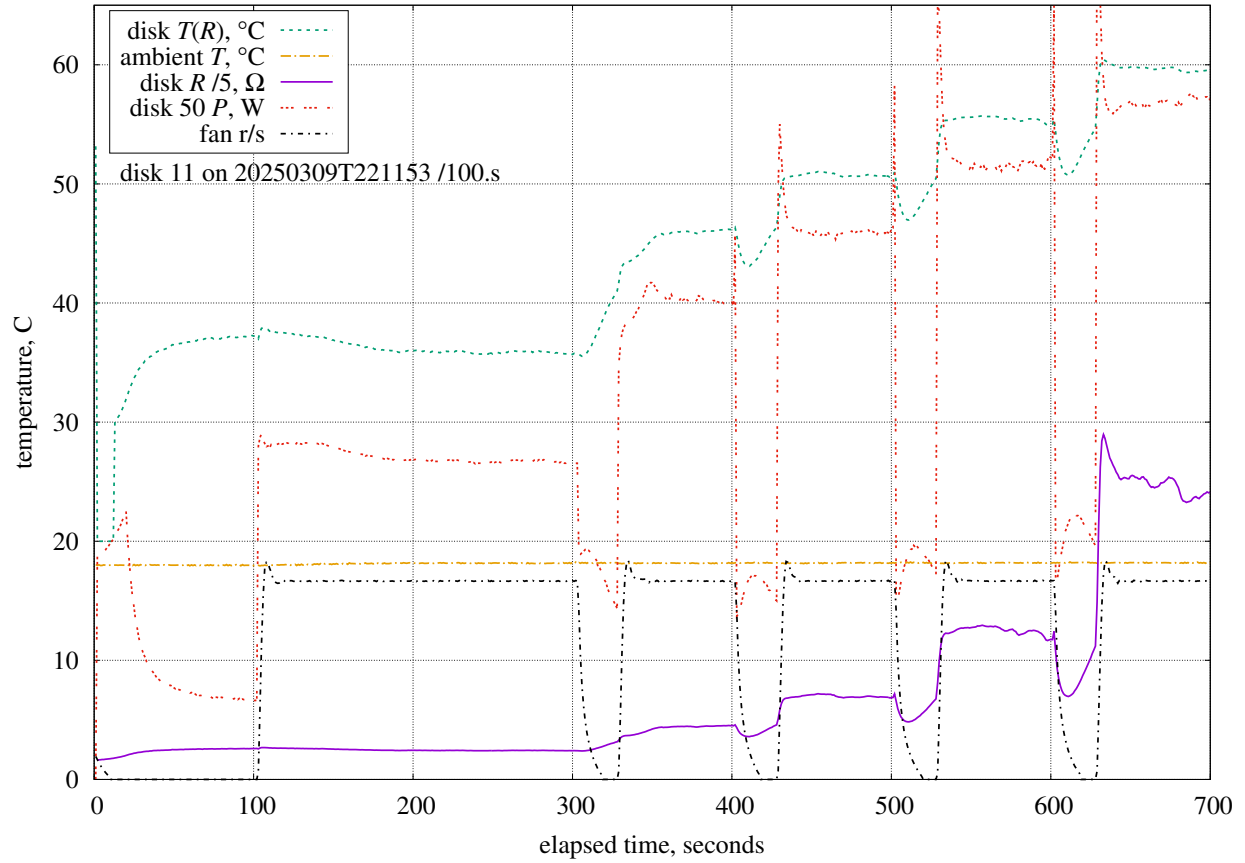
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	$-0.524\%/K$	0.50.K	0.26%	LM35C temperature sensor
$\Delta T$	25.0.K	$+3.58\%/K$	0.10.K	0.36%	LM35C differential
$P$	99.6.kPa	$+0.0005\%/Pa$	1.5.kPa	0.72%	MPXH6115A6U air pressure
$\eta$	0.340	$+126\%$	0.007	0.85%	anemometer calibration
$Re_0$	600	$-0.010\%$	60	0.60%	integration lower-bound
$D_o$	2.81.mm	$-17885\%/m$	500.um	8.94%	tube outer diameter
$D_i$	1.11.mm	$+22916\%/m$	200.um	4.58%	tube inner diameter
$D_g$	166.um	$-651\%/m$	750.um	0.49%	tube air gap
$L_{\text{wire}}$	38.0.mm	$+2712\%/m$	500.um	1.36%	wire length
$k_{\text{ABS}}$	$179. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$+0.224\%/ \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$9.0. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	2.00%	ABS thermal conductivity
$d$	12.0.mm	$+5524\%/m$	100.um	0.55%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	$-50.6\%$	0.010	0.51%	ABS emissivity
$\epsilon_{wt}$	0.900	$-51.5\%$	0.025	1.29%	wind-tunnel emissivity
$\theta$	$50.0.m^\circ$	$-3.48\%/^\circ$	$0.20.^\circ$	0.70%	plate angle
				10.56%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	500.r/min	$+0.086\%/(r/min)$	1.7.r/min	0.14%	fan rotation rate
				10.57%	RSS combined uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 2.131 \text{ m/s}$  (750 r/min)

Estimated measurement uncertainties at  $Re = 1569$ .

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	$-0.540\%/K$	0.50.K	0.27%	LM35C temperature sensor
$\Delta T$	25.0.K	$+3.42\%/K$	0.10.K	0.34%	LM35C differential
$P$	99.6.kPa	$+0.0005\%/Pa$	1.5.kPa	0.69%	MPXH6115A6U air pressure
$\eta$	0.340	$+115\%$	0.007	0.78%	anemometer calibration
$Re_0$	600	$-0.010\%$	60	0.61%	integration lower-bound
$D_o$	2.81.mm	$-20027\%/m$	500.um	10.01%	tube outer diameter
$D_i$	1.11.mm	$+24681\%/m$	200.um	4.94%	tube inner diameter
$D_g$	166.um	$-755\%/m$	750.um	0.57%	tube air gap
$L_{\text{wire}}$	38.0.mm	$+3147\%/m$	500.um	1.57%	wire length
$k_{\text{ABS}}$	$179. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$+0.231\%/\frac{\text{mW}}{\text{K}\cdot\text{m}}$	$9.0. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	2.07%	ABS thermal conductivity
$d$	12.0.mm	$+5647\%/m$	100.um	0.56%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	$-52.4\%$	0.010	0.52%	ABS emissivity
$\epsilon_{wt}$	0.900	$-53.4\%$	0.025	1.34%	wind-tunnel emissivity
$\theta$	$50.0.m^\circ$	$-3.00\%/^\circ$	$0.20.^\circ$	0.60%	plate angle
				11.67%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	750.r/min	$+0.052\%/(r/min)$	1.0.r/min	0.05%	fan rotation rate
				11.67%	RSS combined uncertainty



$\theta = 0.0^\circ$ ;  $\psi = 90.0^\circ$ ;  $V = 2.724 \text{ m/s}$  (999 r/min)

Estimated measurement uncertainties at  $Re = 2006$ .

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$T$	304.K	$-0.593\%/K$	0.50.K	0.30%	LM35C temperature sensor
$\Delta T$	25.0.K	$+3.15\%/K$	0.10.K	0.31%	LM35C differential
$P$	99.6.kPa	$+0.0004\%/Pa$	1.5.kPa	0.67%	MPXH6115A6U air pressure
$\eta$	0.340	$+104\%$	0.007	0.70%	anemometer calibration
$Re_0$	600	$-0.010\%$	60	0.60%	integration lower-bound
$D_o$	2.81.mm	$-22950\%/m$	500.um	11.48%	tube outer diameter
$D_i$	1.11.mm	$+25794\%/m$	200.um	5.16%	tube inner diameter
$D_g$	166.um	$-860\%/m$	750.um	0.64%	tube air gap
$L_{\text{wire}}$	38.0.mm	$+3584\%/m$	500.um	1.79%	wire length
$k_{\text{ABS}}$	$179. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$+0.235\%/ \frac{\text{mW}}{\text{K}\cdot\text{m}}$	$9.0. \frac{\text{mW}}{\text{K}\cdot\text{m}}$	2.11%	ABS thermal conductivity
$d$	12.0.mm	$+5674\%/m$	100.um	0.57%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	$-58.4\%$	0.010	0.58%	ABS emissivity
$\epsilon_{wt}$	0.900	$-59.5\%$	0.025	1.49%	wind-tunnel emissivity
$\theta$	$50.0.m^\circ$	$-2.75\%/^\circ$	$0.20.^\circ$	0.55%	plate angle
				13.08%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	999.r/min	$+0.035\%/(r/min)$	2.0.r/min	0.07%	fan rotation rate
				13.08%	RSS combined uncertainty