Instruction & Operation Manual

FlowReadout™

Model FR-9600

Serial No. _____

ThermoFlow™ Analyzer

Model FA-9600

Serial No. _____

For Use With RotoFlow™ Products

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FP-I-40-B-1

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Introduction

Congratulations!

We would like to **thank you** for your purchase of our **FlowReadout™** for flow measurements or our hand held **ThermoFlow™ Analyzer** for comprehensive temperature/flow diagnostic measurements. All flow measurements are based on a sound turbine principal, which provides a predictable linear output. We use new technology in a non-restrictive infrared flow sensor head, making this the most innovative flow measuring device available. We trust that you will find these instruments to be a valuable asset to your flow and temperature trouble-shooting and monitoring equipment.

Description of FlowReadout™

The **FlowReadout™** is a portable hand held flow measuring instrument that is used in conjunction with CITO's StackFlow™, StackValve™, StackController™, and RotoFlow™ Products.

The infrared flow sensor responds to each pass of the rotary turbine blade. Each flow turbine assembly may be calibrated to its flow rate (k-factor = pulses per gallon). The turbine assembly has inherent linear behavior, and requires no linearization for an accurate reading.

Additional features such as maximum and minimum flow, accumulative flow, and high or low flow alarms can be displayed. The measured values can be displayed in either English or Metric units. All selections and calibrations are done digitally on the keyboard.

Description of Thermoflow™Analyzer

The **ThermoFlow™ Analyzer** is a portable hand held flow and temperature measuring instrument and is used in conjunction with CITO's StackFlow™, StackValve™, StackController™, and RotoFlow™ Products.

The unit was designed to measure and display temperature, flow, and BTU's status; thus current heat exchange measurement can be provided from the mold or heat exchanger.

The infrared flow sensor responds to each pass of the rotary turbine blade. Each flow turbine assembly may be calibrated to its flow rate (k-factor = pulses per gallon). The turbine assembly has inherent linear behavior, and requires no linearization for an accurate reading.

The temperature input is a single or dual thermocouple (t1 and t2).

Additional features such as maximum and minimum temperature, accumulative flow, and high or low flow alarms can be displayed. The measured values can be displayed in either English or Metric units. All selections and calibrations are done digitally on the keyboard.

For monitoring purposes or data logging we have provided an AC power converter and a 0-5 volt data output connection cable.

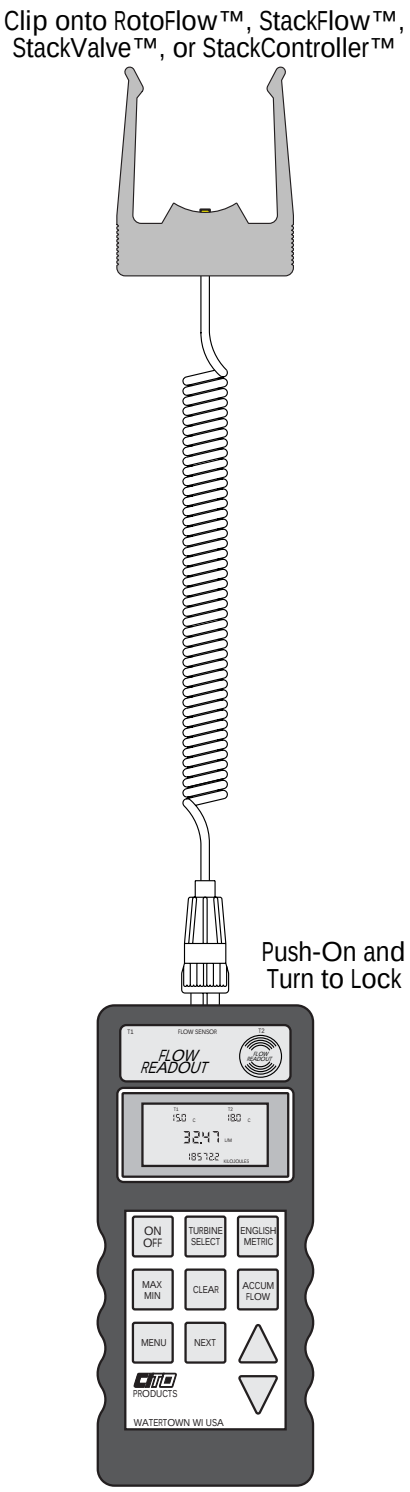
FlowReadout™ Specifications

Unit

Power:	9 VDC alkaline battery
	Current Draw: 30 mA
	Battery Life: Approximately 10 hours
	Auto turn off after 3 minutes (can be disabled)
	Low Battery Indication (below 6 VDC)
	Optional 120/9 Volt AC converter
Display Accuracy:	+,- 1 digit
Display Repeatability:	+,- 1 digit
Display Units:	English or Metric (GPM/LPM)
Display Resolution:	3 Blade Turbine .01 Liter, .01 Gallon
	6 Blade Turbine .01 Liter, .01 Gallon
Turbine Select:	3 Blade High
	3 Blade Low
	6 Blade Low
Accumulative Flow:	.1 to 144 hours
Time Units:	.1 hour (6 minutes)

Flow Input Sensor

Pick Up Type:	Infrared
Infrared Tuning:	Automatic Self Adjusting
Input Sample Rate:	Once per 200 ms
Display Update:	1 per second
Pick Up Status:	No pick up: Blank display (--)
	Note: Exposure to ambient light will give erroneous readings



ThermoFlow™ Analyzer Specifications

Unit

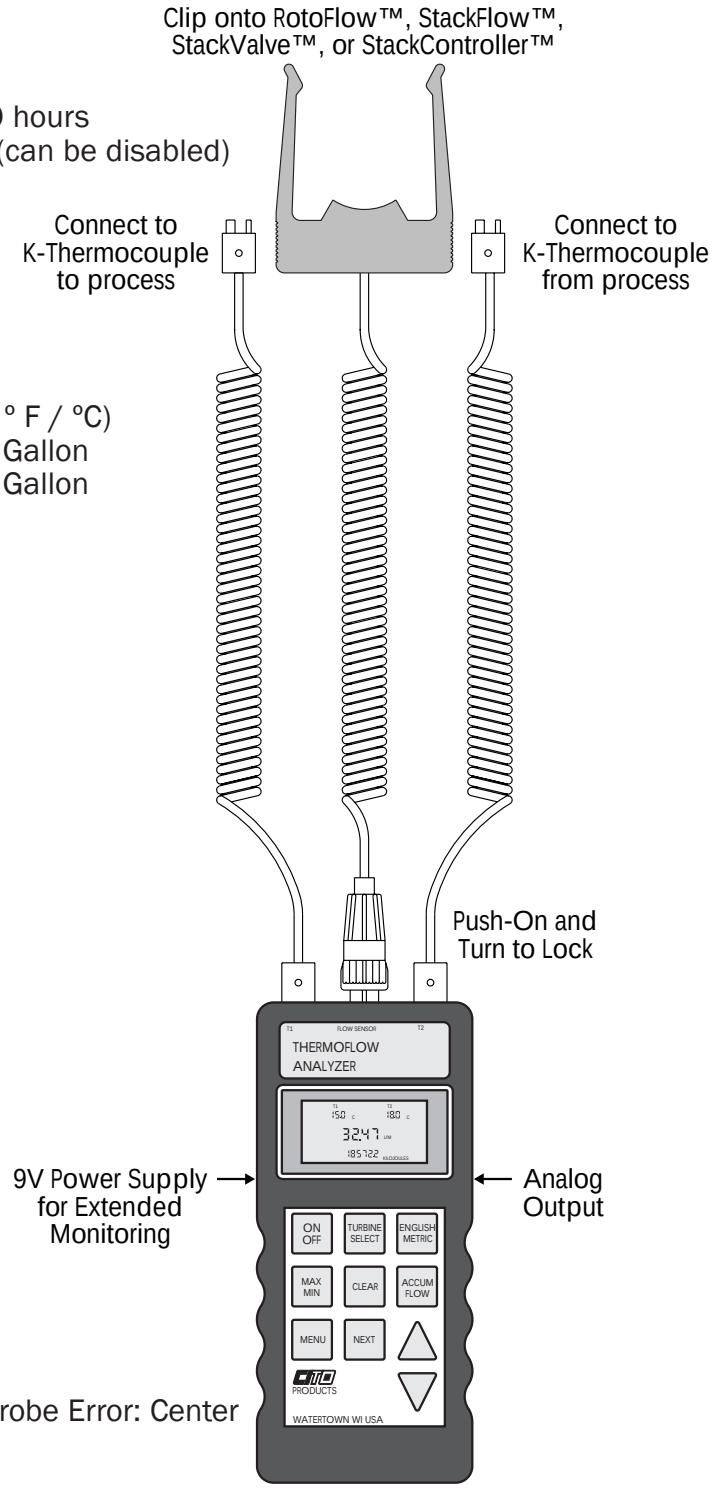
Power:	9 VDC alkaline battery Current Draw: 30 mA Battery Life: Approximately 10 hours Auto turn off after 3 minutes (can be disabled) Low Battery Indication (below 6 VDC) Optional 120/9 Volt AC converter
Display Accuracy:	+,- 1 digit
Display Repeatability:	+,- 1 digit
Display Units:	English or Metric (GPM/LPM, BTU's/Kilojoules, ° F / °C)
Display Resolution:	3 Blade Turbine .01 Liter, .01 Gallon 6 Blade Turbine .01 Liter, .01 Gallon
Temp. Resolution:	.1 Degree Fahrenheit
Turbine Select:	3 Blade High 3 Blade Low 6 Blade Low
Accumulative Flow:	.1 to 144 hours
Time Units:	.1 hour (6 minutes)
Analog Output:	0 to 5 VDC, 2 mA

Flow Input Sensor

Pick Up Type:	Infrared
Infrared Tuning:	Automatic Self Adjusting
Input Sample Rate:	Once per 200 ms
Display Update:	1 per second
Pick Up Status:	No pick up: Blank display (--) Note: Exposure to ambient light will give erroneous readings

Temperature Inputs

Sensor Type:	K Type Thermocouple
Temperature Range:	32° F to 999.9° F 0°C to 537° C
Input Sample Rate:	Once per 200 ms
Display Update:	Once per second
Probe Offset:	Field Adjustable
Probe Status:	Continuously monitored No probe: Blank display (--) Probe Error: Center segment will light



Quick Start Up Guide - Measure Flow

Hardware Requirements

FlowReadout™
Flow Pick Up Head
StackFlow™, StackValve™, StackController™
or RotoFlow™

ThermoFlow™ Analyzer
Flow Pick Up Head
K type thermocouple(s)
StackFlow™, StackValve™, StackController™
or RotoFlow™

Quick Start Instructions

1. Unpack unit and inspect contents for damage during shipping.

2. Remove **Flow Readout™/ThermoFlow™ Analyzer** and plug in Flow Sensor at the top of the unit (see page 4).

3. If desired, install temperature sensors in the appropriate connector at the top of the **ThermoFlow™ Analyzer** (see page 5).

4. Press the **ON/OFF** button momentarily to turn the unit ON.

5. Unit goes through start up routine first, then temperature will be displayed.

6. Read label or window on RotoFlow™ (RF) 3 BL-H, 3 BL-L or 6 BL LL

Read window on StackFlow™	(SF)	HIGH	set flow range to	3 BL-H
		LOW	set flow range to	3 BL-L
		L-LOW	set flow range to	6 BL LL
Read window on StackValve™	(SV)	HIGH	set flow range to	3 BL-H
		LOW	set flow range to	3 BL-L
		LOW	set flow range to	6 BL LL
Read window on StackController™	(SC)	HIGH	set flow range to	3 BL-H
		LOW	set flow range to	3 BL-L
		L-LOW	set flow range to	6 BL LL

7. Make turbine selection on **FlowReadout™/ThermoFlow™ Analyzer**.
   To change push **TURBINE SELECT**, make selection and release (see page 8).

8. Read Flow Correction (FC) on label - or see charts on pages 17 through 21.

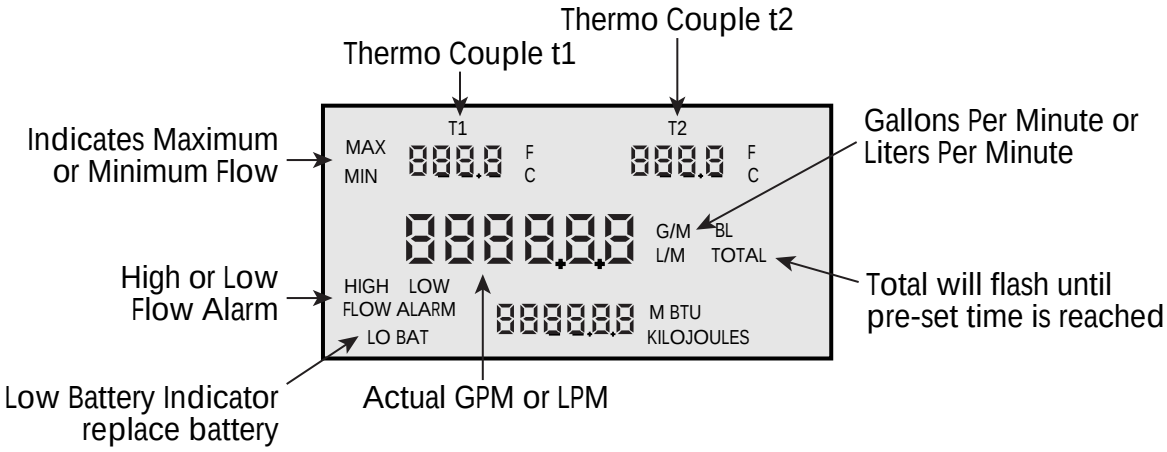
10. To change: push **MENU,** (FC) **UP ARROW** or **DOWN ARROW** from 0 to 2000 (see page 9).

11. Snap the Flow Sensor on to the turbine indicator of a StackFlow™, StackValve™, StackController™, or RotoFlow™.

12. If flow is present through the turbine your **FlowReadout™/ThermoFlow™ Analyzer** will begin reading flow immediately.

Display Basics

Full display shown during start up and shut down.

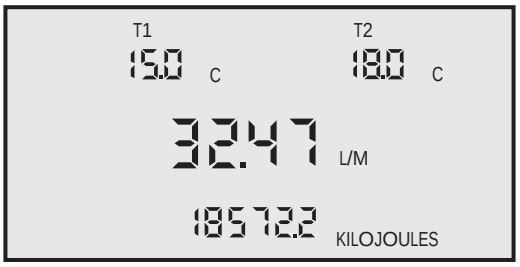


Under normal running conditions only portions of this display will be shown.

FlowReadout™ Display

Display shows Flow in Metric or English Units.

ThermoFlow™ Display



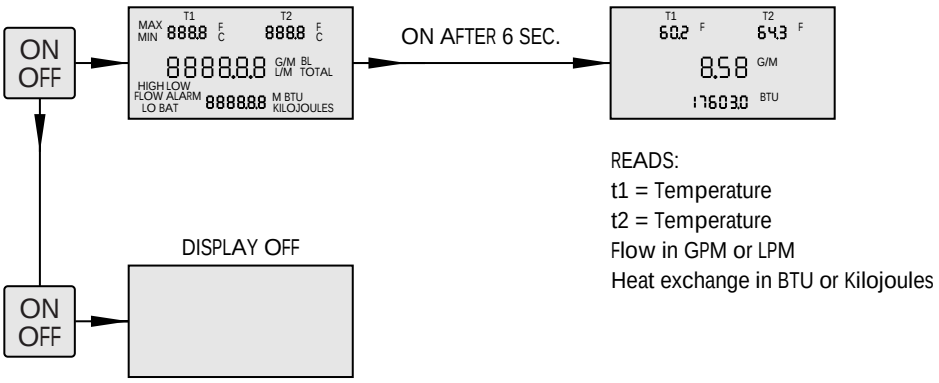
Display shows flow in LPM or GPM, t1 temperature, t2 temperature, and heat units in Metric or English Units.

ON
OFF

ON/OFF

Depressing this key will toggle the unit ON or OFF depending on its previous state.

FOR AUTO SHUT DOWN
SEE PAGE 15



TURBINE
SELECT

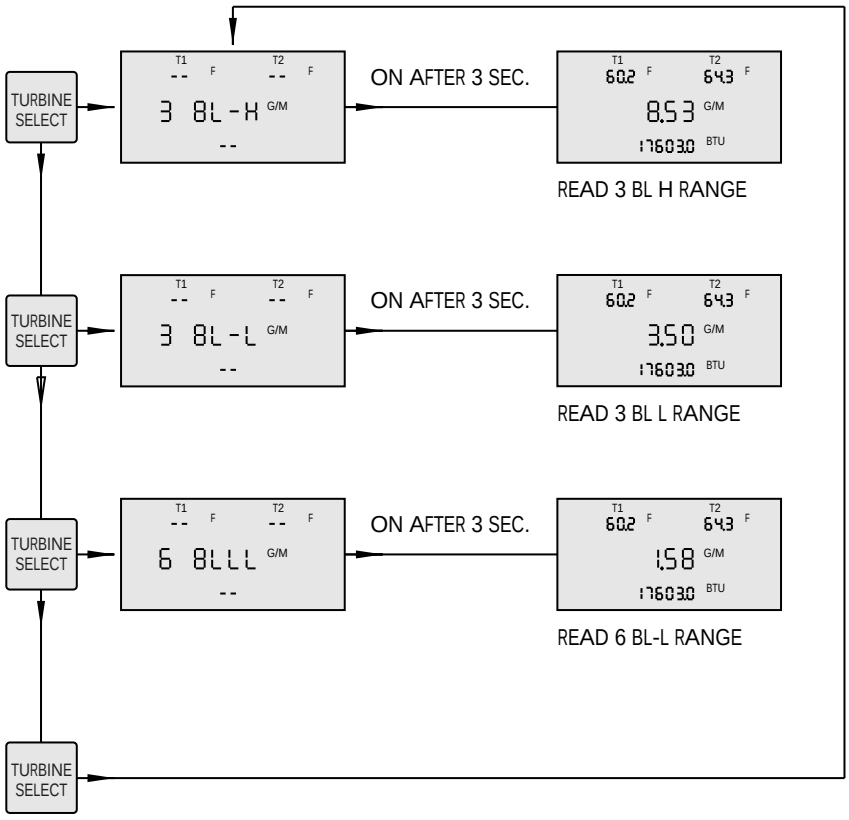
TURBINE SELECT

Depressing **TURBINE SELECT** will toggle the display through three turbine choices. It is necessary to match the meter with the correct turbine.

THIS INFORMATION IS
PRINTED
ON EACH TURBINE
ASSEMBLY

The three choices are:

- 3 BL-H (three blade turbine) HIGH FLOW
- 3 BL-L (three blade turbine) LOW FLOW
- 6 BL LL (six blade turbine) LOW-LOW FLOW

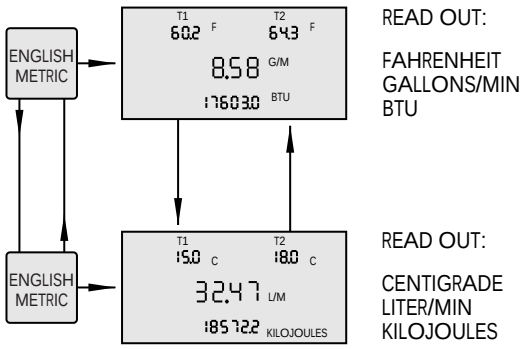


ENGLISH
METRIC

ENGLISH/METRIC

Depressing this button will toggle the unit from English display units to Metric display units.

- English Units Displayed:
  °Fahrenheit, GPM, & BTU's
- Metric Units Displayed:
  °Centigrade, LPM, & Kilojoules

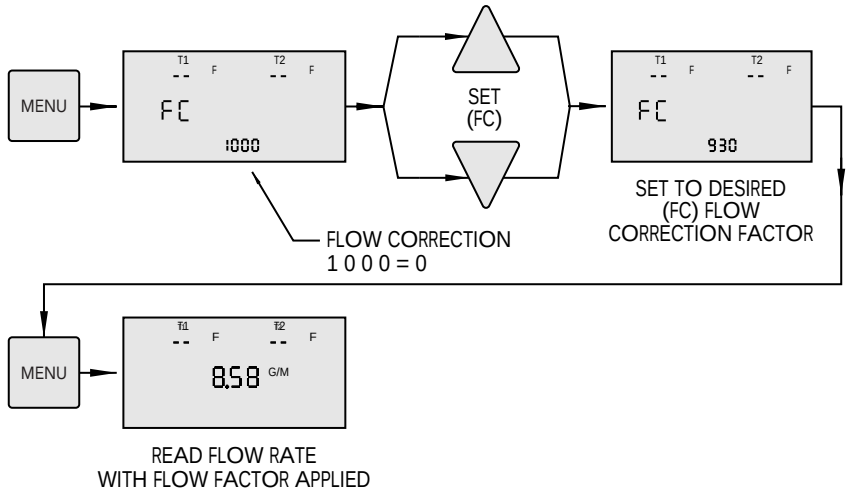


MENU

FLOW CORRECTION (FC)

The Flow Correction (FC) is used to adjust for various velocities through a variety of pipe sizes. Each RotoFlow™ or Stack Product label has a Flow Correction (FC) listed.

Push the **MENU** key and use the **ARROW UP** and **DOWN KEYS** to set the 'FC' to match the number given on the RotoFlow™ or Stack Product label. (For a listing of Flow Correction for all turbine units, please see pages 21-27).



TO CALIBRATE TO A KNOWN FLOW

$$\frac{\text{Known Flow}}{\text{Reading of FlowReadout™}} = \text{Flow Correction (FC)}$$

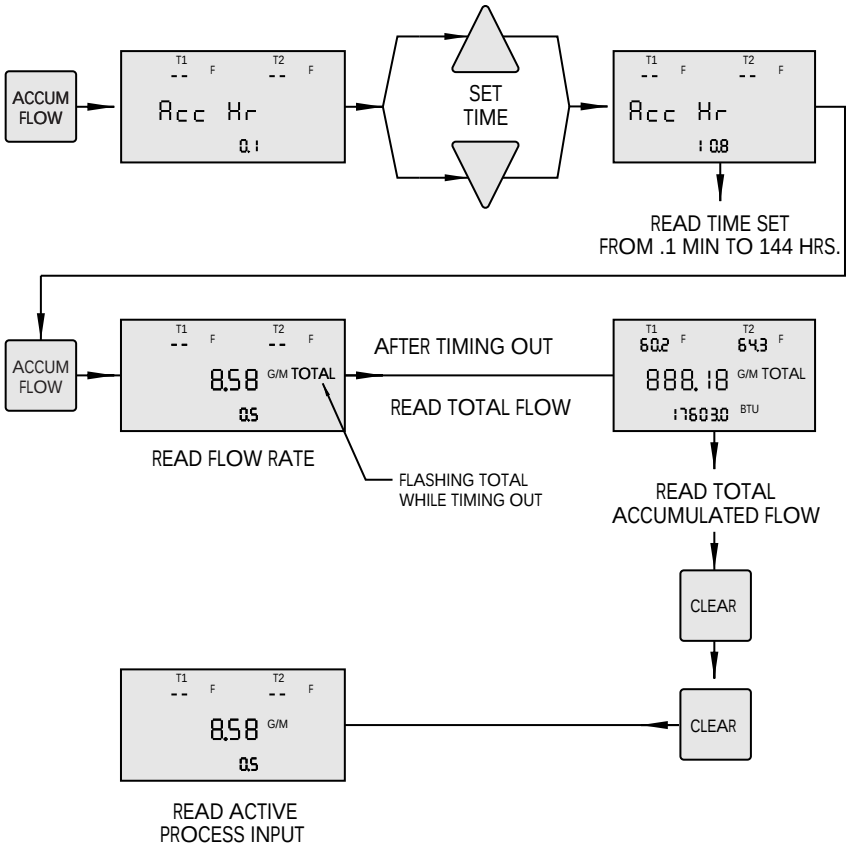
Example: $\frac{\text{Known Flow is 46.4 GPM}}{\text{Reading of FlowReadout™ is 41.12}} = 1.138$

Set Flow Correction (FC) to 1138
The decimal point is not used

ACCUM FLOW

ACCUM FLOW

The **ACCUMULATIVE FLOW** key allows the user to record the amount of liquid that has flown through the turbine in a specified time period. To activate, push **ACCUM FLOW** key, the bottom center of the display will indicate the time period of the recording. To adjust the time period from .1 hrs. to 144 hrs. depress the up or down arrow key until the desired time period is displayed. Pressing the up or down arrow key, time will advance up or down in one/tenth hour increments for each touch. Press the accumulative flow key, the unit will go back to the monitor condition. The **TOTAL** annunciator will blink every second to indicate accumulative flow is active. Once the accumulative time period has elapsed the display will show the accumulative flow total in gallons or liters. The unit will display the totaled gallons or liters until the **CLEAR** key is pressed twice in succession, thus, resetting the totaled amount back to zero and the **FlowReadout™** or **ThermoFlow™Analyzer** back to the standard monitor condition.



Example: You need to know how much water is required to cool a mold in a 8 hour period. Enter the accumulative flow mode and use the arrow keys to adjust the time until 8.0 is displayed. Once the accumulative time period has elapsed the display will show the flow total through the mold in gallons or liters. The unit will display the totaled gallons or liters until the **CLEAR** key is pressed twice in succession.

MAX
MIN

MAX/MIN

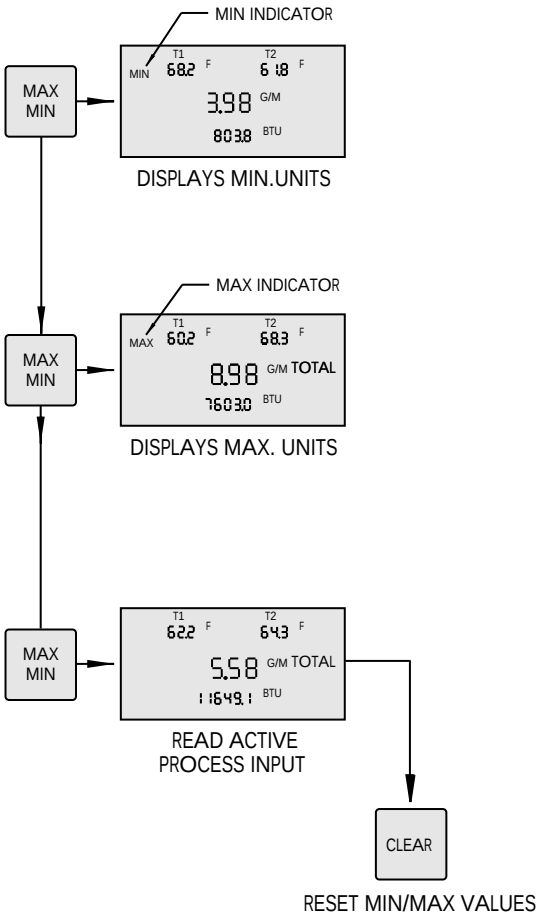
Depressing the **MAX/MIN** key allows the user to view the maximum and minimum values of flow, temperature, and energy.

Push **MAX/MIN** key to display the minimum value for t1, t2, GPM (LPM), and BTU's (Kilojoules).

Push **MAX/MIN** again to display the maximum value for t1, t2, GPM (LPM), and BTU's (Kilojoules).

The unit will return back to the monitoring mode 5 seconds after the **MAX/MIN** key is released.

To reset the **MAX/MIN** value, push the **CLEAR** key (when in active processing mode).



Temperature Sensor Offset

MENU | NEXT

t1 Temperature Offset

This key provides the operator the means to calibrate the thermocouple to a known temperature. Insert Probe into a known temperature bath.

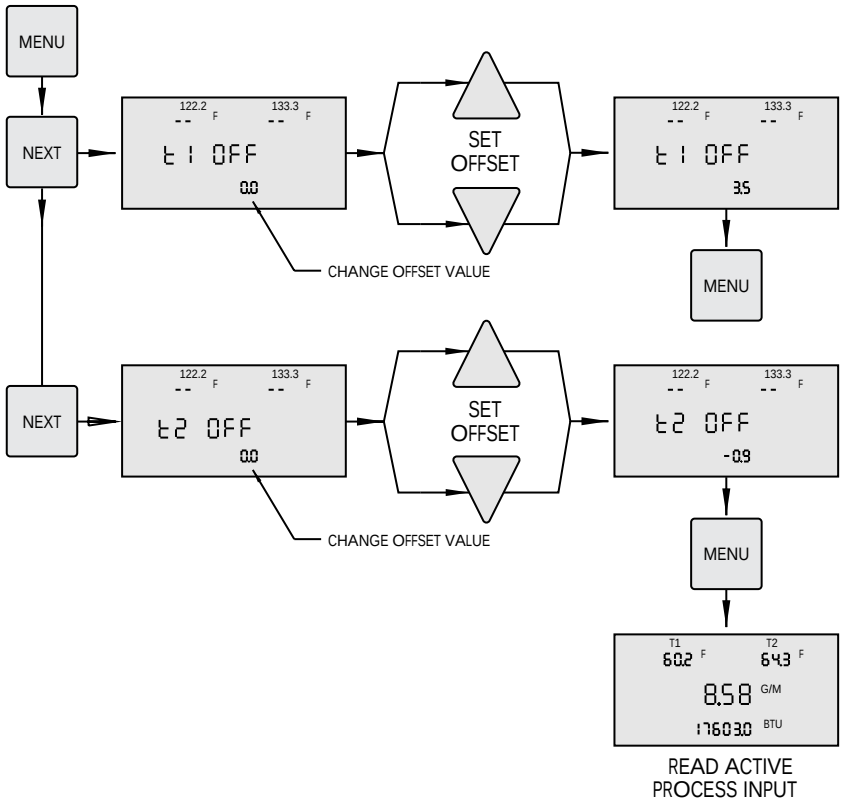
t1 temperature will be displayed on the LCD. If displayed temperature is lower than the known temperature:

Scroll offset temperature adjustment up using **ARROW UP** key until the offset amount is equal to the difference in temperature.

If the displayed temperature is higher than the known temperature:

Scroll the offset temperature adjustment down using the **ARROW DOWN** key, until the offset amount is equal to the difference in temperature.

To exit push **MENU.**



NOTE: Maximum offset is 10°F or 10°C

MENU | NEXT | NEXT

t2 Temperature Offset

Push **Menu**, then push **NEXT** twice.

Follow instructions listed above for t1.

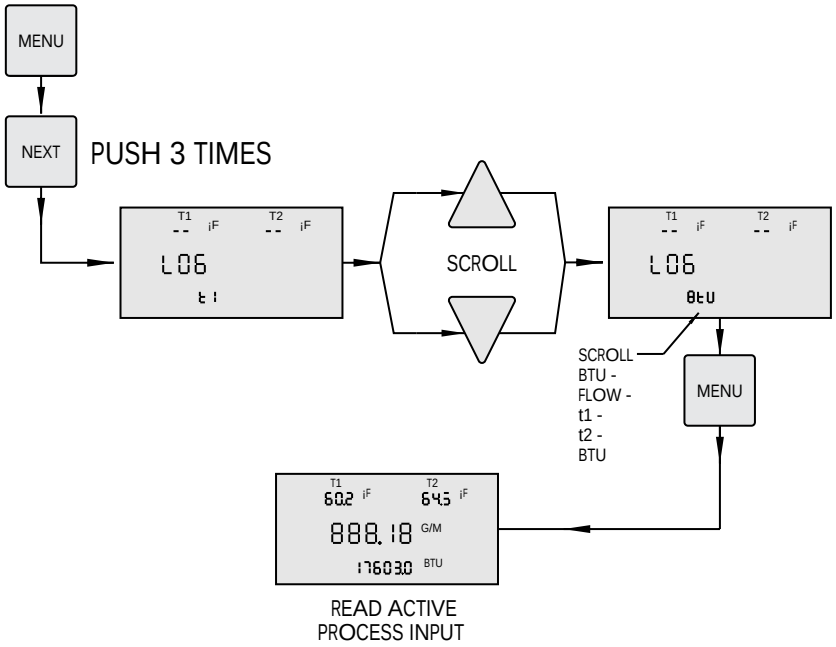
To exit push **MENU.**

Analog Output

MENU	NEXT	NEXT	NEXT

Log Analog Output

The **ThermoFlow™ Analyzer**'s analog output has been provided to log or record flow, temperature or energy data over extended periods of time. This information can be tied to statistical process information, alarm indication, trouble shooting, and many other applications. The information is provided in a analog 0-5 VDC output. This common format can be fed directly into many chart recorders, analog to digital convertors, and processing programs.



Connections to the Analog Output are made through the connector on the right side of the **ThermoFlow™ Analyzer** as shown - see page 5.

For extended monitoring plug in the 9 VDC power supply on the left side of the **ThermoFlow™ Analyzer**.

The connector used for Analog Output is a Micro-Plug Subminiature Phone Plug, Switch Craft, Type 850. The Center pin is + VDC, outside connection is - VDC, 2 mA max draw.

The operator must choose one of four output channels available. The outputs you can log are either FLOW, t1, t2 or BTU Selection. Selection of the active output is made by the following steps:

1. Push the **MENU** key and display will read FC.
2. Push the **NEXT** key three times, until display reads LOG.
3. Use the **ARROW DOWN** key to select output.
   - t1 Temperature
   - t2 Temperature
   - FLO Flow
   - Btu

4. Push the **MENU** key to return to read active process reading
5. Selected output will now be logged to the analog output port.

Output Flow: .062VDC/GAL.
Temperature:.005VDC per °F
0 BTU = 2.500VDC (OFFSET)
.000497 VDC/BTU

Example: 16.66GPM x .062=1.033Volt Output
450°F x 005 = 2.25 Volt Output

4,000 BTU x .000497 = 1.988 Volt Output
Negative and Positive BTUs may be recorded
1.988 + 2.500 = 4.488 VDC OUTPUT

HI/LO Flow Alarm

MENU	NEXT	NEXT	NEXT	NEXT

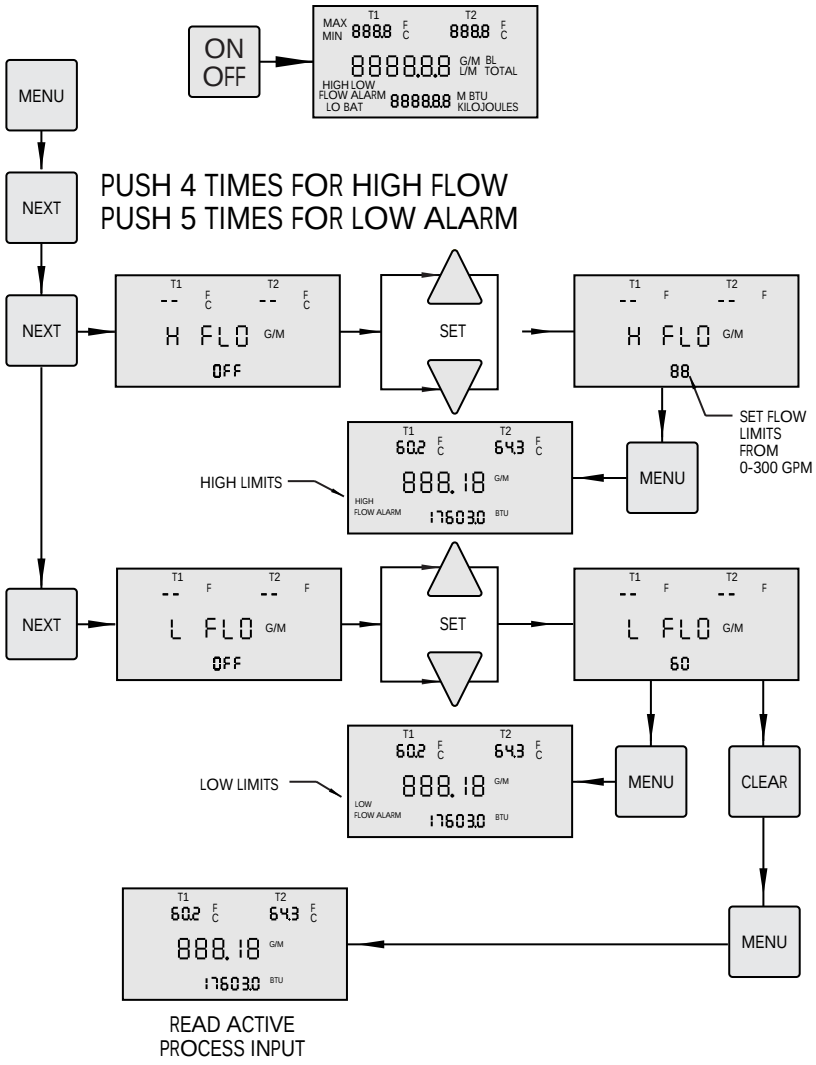
Hi Flo Alarm

Push **MENU**, then push **NEXT** 4 times.

Use **ARROW UP** and **ARROW DOWN** keys to enter: 0-300 GPM (LPM).

Note: To set Low Flow Alarm, immediately push **NEXT**, and follow instructions listed for Hi Flow Alarm.

To activate alarm and exit push **MENU.**



To clear alarm and exit push **MENU,** and then push **NEXT** four times, **CLEAR**, and **MENU.**

MENU	NEXT	NEXT	NEXT	NEXT	NEXT

Lo Flo Alarm

Push **MENU**, then push **NEXT** 5 times.

Use **ARROW UP** and **ARROW DOWN** keys to enter: 0-300 GPM (LPM).

To activate alarm and exit push **MENU**.

To clear alarm and exit push **MENU,** and then push **NEXT** five times, **CLEAR**, and **MENU.**

Auto Shut Down (Battery Saver)

MENU	NEXT	NEXT	NEXT	NEXT	NEXT	NEXT

Auto Shut Down

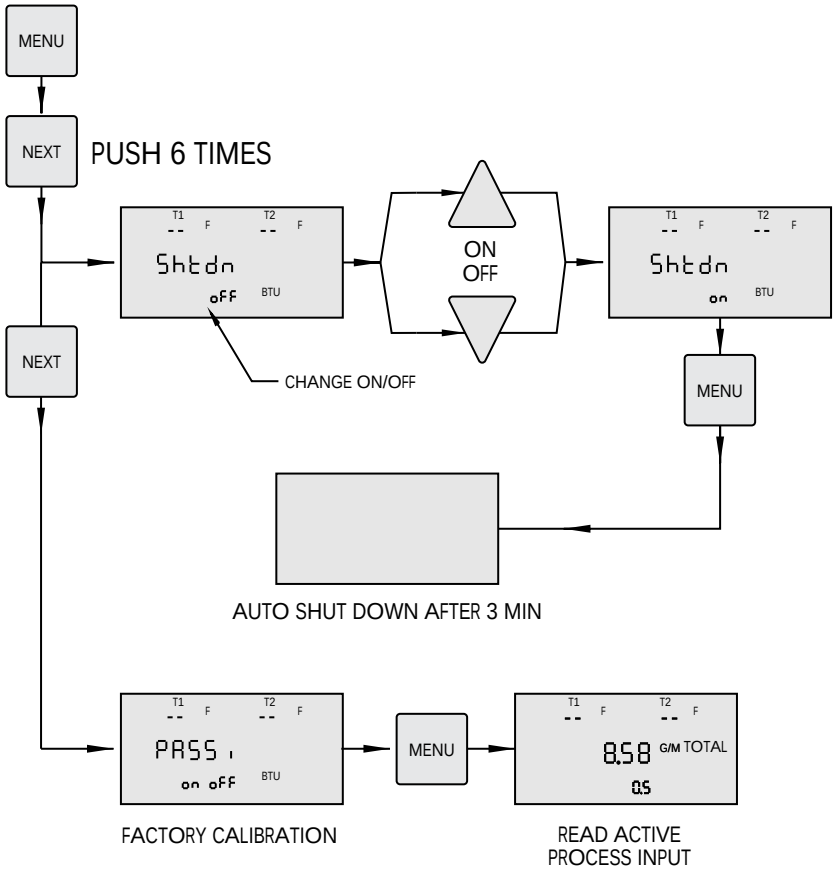
The unit comes from the factory with the Auto Shut Down “ON”. After 3 minutes the **FlowReadout™** and **ThermoFlow™ Analyzer** will shut down to extend the battery life.

Use this function to change to Manual Shut Down.

Push **MENU**, then push **NEXT** 6 times.

Use **ARROW UP** and **ARROW DOWN** keys to enter "on" or "off".

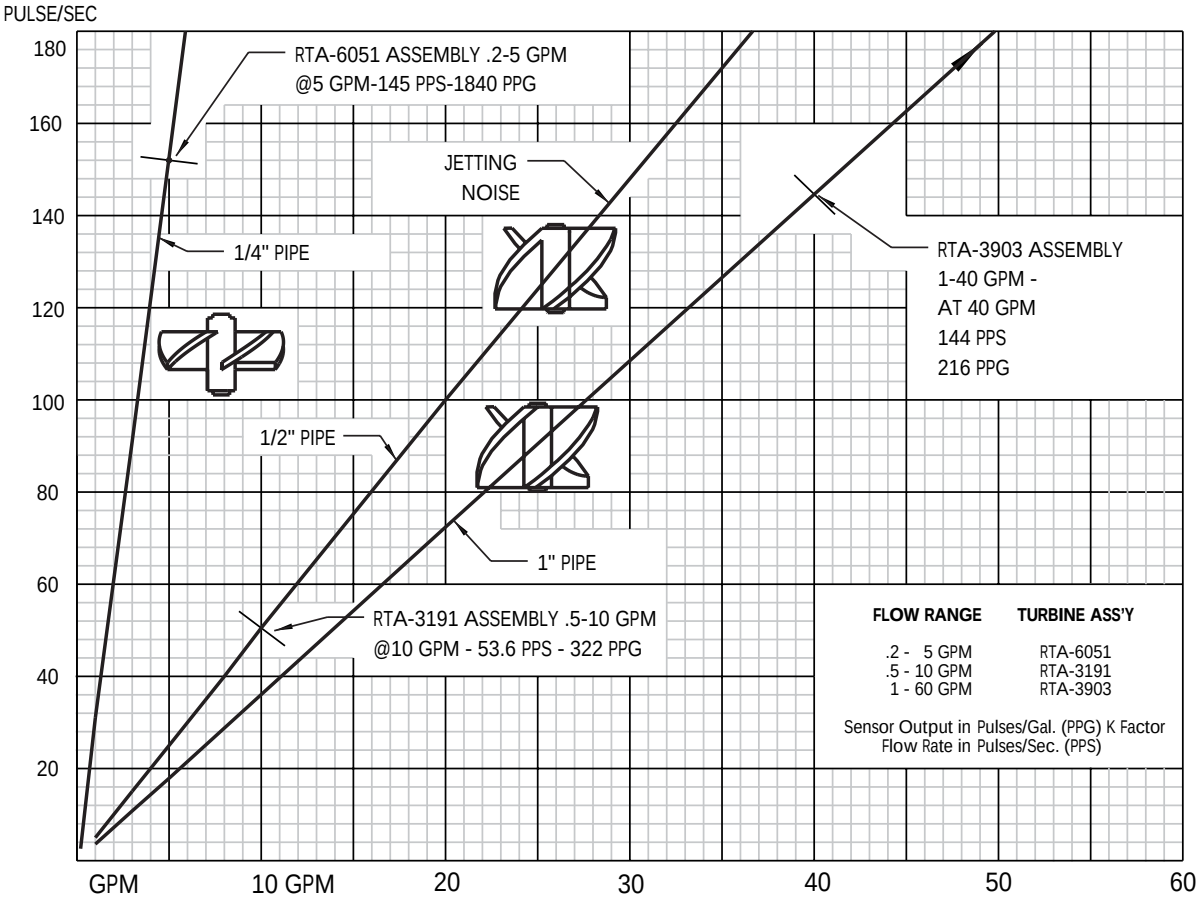
To exit push **MENU.**

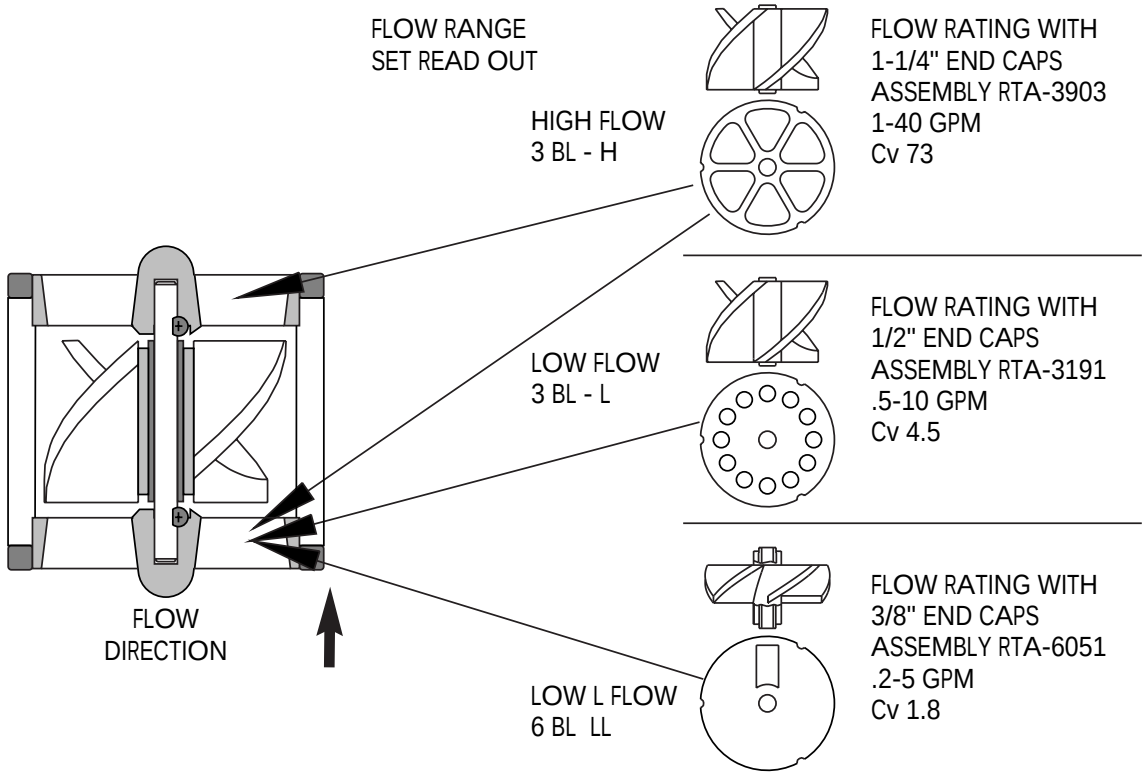


Pass

This is a factory calibration function.

TURBINE ASSEMBLY SELECTION





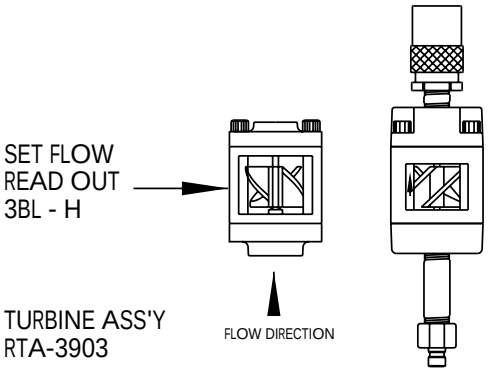
Models RFH, RFL and RF6

NOTE: TO OBTAIN CORRECT FLOW READING -
USE FACTORY ASSEMBLED ROTOFLOW™ WITH STRAIGHT INLET PIPE
PERFORMANCE ACCURACY + - 2% REPEATABILITY < .5%

MAKE TURBINE SELECTION
1. SELECT FLOW RANGE
2. DETERMINE PIPE SIZE
3. INSTALL ASSEMBLY

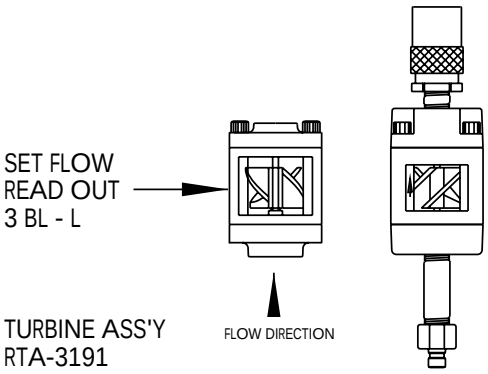
1. Check marking on TURBINE ASSEMBLY WINDOW
2. Read - HIGH FLOW SET 3 BL - H
   LOW FLOW 3 BL - L
   L- LOW FLOW 6 BL LL
3. Set **TURBINE SELECT** - on meter (see page 8)
4. Read Flow Correction (FC) on label
5. Set Flow Correction (FC) (see page 9)
6. Place pick up head on turbine and read flow

VALUES LISTED BELOW ARE FOR REFERENCE ONLY
READ LABEL ON PRODUCT.



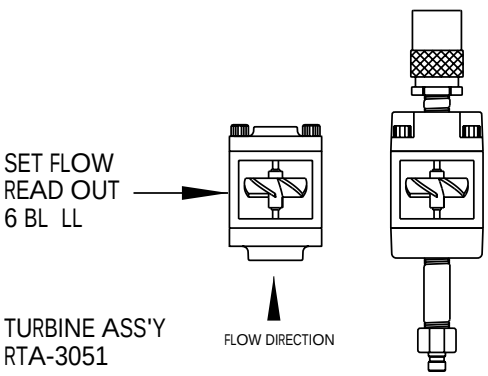
FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
1-5 GPM	1/4" X 3"	532	406	2.5	2 GPM	RFH-0404-C
1-12 GPM	3/8" X 4"	662	326	5.5	5 GPM	RFH-0606-C
1-22 GPM	1/2" X 4"	755	286	10	5 GPM	RFH-0808-C
1-40 GPM	3/4" X 4"	884	244	18	10 GPM	RFH-1212-S
1-60 GPM	1" X 5"	1008	214	29	10 GPM	RFH-1616-S
1-60 GPM	1-1/4" X 6"	990	218	31	10 GPM	RFH-2020-S

NOTE: Model number shown without pipe,
Flow Rate applies to both models.



FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-2.4 GPM	1/8" X 3"	894	360	1.1	2 GPM	RFL-0202-C
.5-5.5 GPM	1/4" X 3"	1038	310	2.3	2 GPM	RFL-0404-C
.5-8 GPM	3/8" X 4"	1000	322	3.6	5 GPM	RFL-0606-C
.5-10 GPM	1/2" X 4"	1006	320	4.5	5 GPM	RFL-0808-C

NOTE: Model number shown without pipe,
Flow Rate applies to both models.



FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-.8 GPM	1/8" X 3"	948	1940	.36	.5 GPM	RF6-0202-C
.2-3.4 GPM	1/4"X 3"	944	1950	1.5	2 GPM	RF6-0404-C
.2-4.0 GPM	3/8"X 4"	938	1960	1.8	2 GPM	RF6-0606-C

NOTE: Model number shown without pipe,
Flow Rate applies to both models.

Models RSH, RSL and RS6

NOTE: TO OBTAIN CORRECT FLOW READING - USE ROTOFLOW WITH STRAIGHT INLET PIPE.
PERFORMANCE ACCURACY + - 2% REPEATABILITY < .5%

MAKE TURBINE SELECTION
1. SELECT FLOW RANGE
2. DETERMINE PIPE SIZE
3. INSTALL ASSEMBLY

1. Check marking on TURBINE ASSEMBLY WINDOW
2. Read - HIGH FLOW SET 3 BL - H
   LOW FLOW 3 BL - L
   L- LOW FLOW 6 BL LL
3. Set **TURBINE SELECT** - on meter (see page 8)
4. Read Flow Correction (FC) on label
5. Set Flow Correction (FC) (see page 9)
6. Place pick up head on turbine and read flow

VALUES LISTED BELOW ARE FOR REFERENCE ONLY
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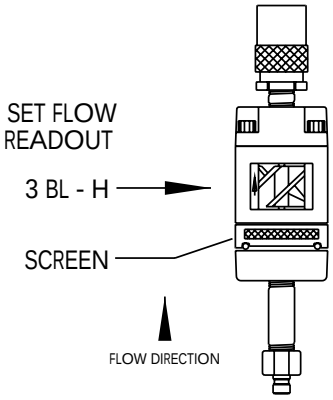
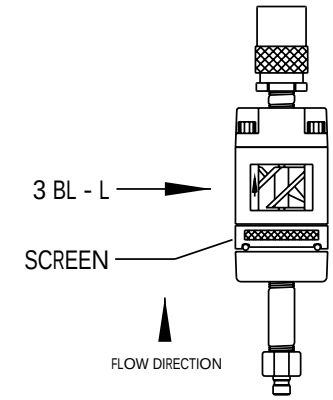
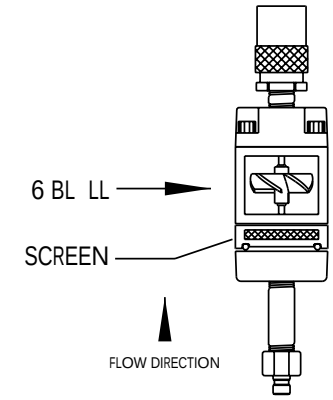


FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
1-5 GPM	1/4" X 3"	1080	200	2.5	2 GPM	RSH-0404-C
1-12 GPM	3/8" X 4"	1064	203	5.5	5 GPM	RSH-0606-C
1-22 GPM	1/2" X 4"	1023	211	10	5 GPM	RSH-0808-C
1-40 GPM	3/4" X 4"	1009	214	18	10 GPM	RSH-1212-S
1-60 GPM	1" X 5"	1000	216	29	10 GPM	RSH-1616-S



FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-2.4 GPM	1/8" X 3"	1095	294	1.1	2 GPM	RSL-0202-C
.5-5.5 GPM	1/4" X 3"	1091	295	2.3	2 GPM	RSL-0404-C
.5-8 GPM	3/8" X 4"	1012	318	3.6	5 GPM	RSL-0606-C
.5-10 GPM	1/2" X 4"	1006	320	4.5	5 GPM	RSL-0808-C



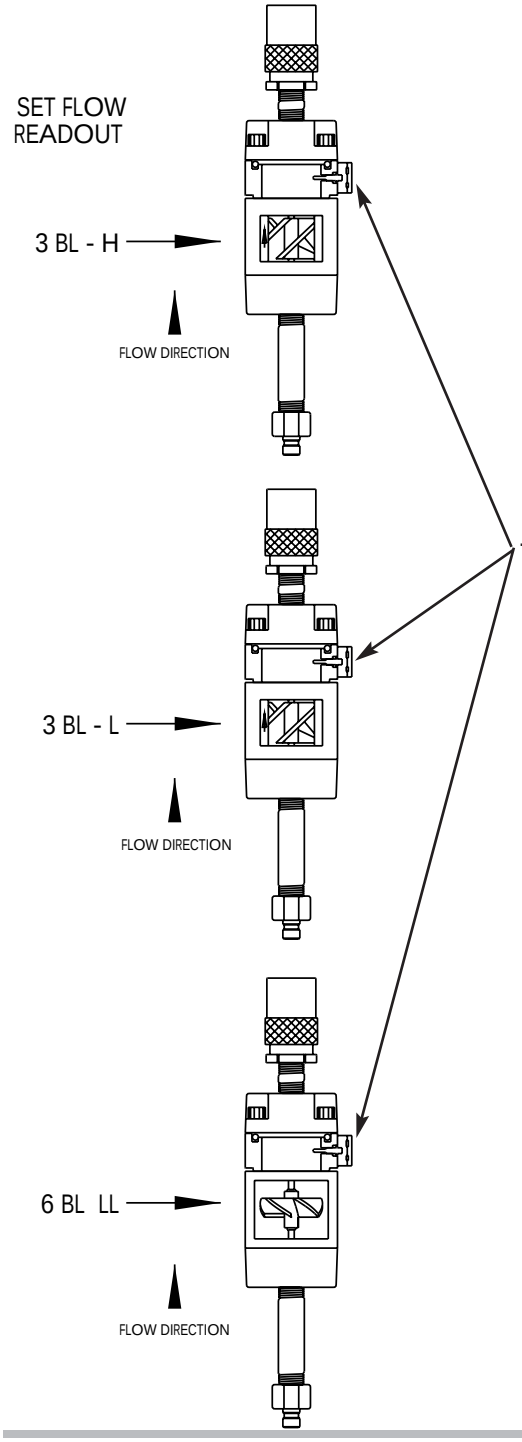
FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-.8 GPM	1/8" X 3"	920	2000	.36	.5 GPM	RS6-0202-C
.2-3.4 GPM	1/4" X 3"	933	1972	1.5	2 GPM	RS6-0404-C
.2-4.0 GPM	3/8" X 4"	917	2006	1.8	2 GPM	RS6-0606-C

RotoFlow™ Selection with Temperature Cap. (Type K TC)

Models RTH, RTL and RT6

NOTE: TO OBTAIN CORRECT FLOW READING - USE ROTOFLOW WITH STRAIGHT INLET PIPE.
PERFORMANCE ACCURACY + - 2% REPEATABILITY < .5%

MAKE TURBINE SELECTION
1. SELECT FLOW RANGE
2. DETERMINE PIPE SIZE
3. INSTALL ASSEMBLY



1. Check marking on TURBINE ASSEMBLY WINDOW
2. Read - HIGH FLOW SET 3 BL - H
   LOW FLOW 3 BL - L
   L- LOW FLOW 6 BL LL
3. Set **TURBINE SELECT** - on meter (see page 8)
4. Read Flow Correction (FC) on label
5. Set Flow Correction (FC) (see page 9)
6. Place pick up head on turbine and read flow

VALUES LISTED BELOW ARE FOR REFERENCE ONLY
READ LABEL ON PRODUCT

FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
1-5 GPM	1/4" X 3"	577	374	2.5	2 GPM	RTH-0404-C
1-12 GPM	3/8" X 4"	670	322	5.5	5 GPM	RTH-0606-C
1-22 GPM	1/2" X 4"	750	288	10	5 GPM	RTH-0808-C
1-40 GPM	3/4" X 4"	912	236	18	10 GPM	RTH-1212-S
1-60 GPM	1" X 5"	986	219	29	10 GPM	RTH-1616-S
1-60 GPM	1-1/4" X 6"	986	219	31	10 GPM	RTH-2020-S

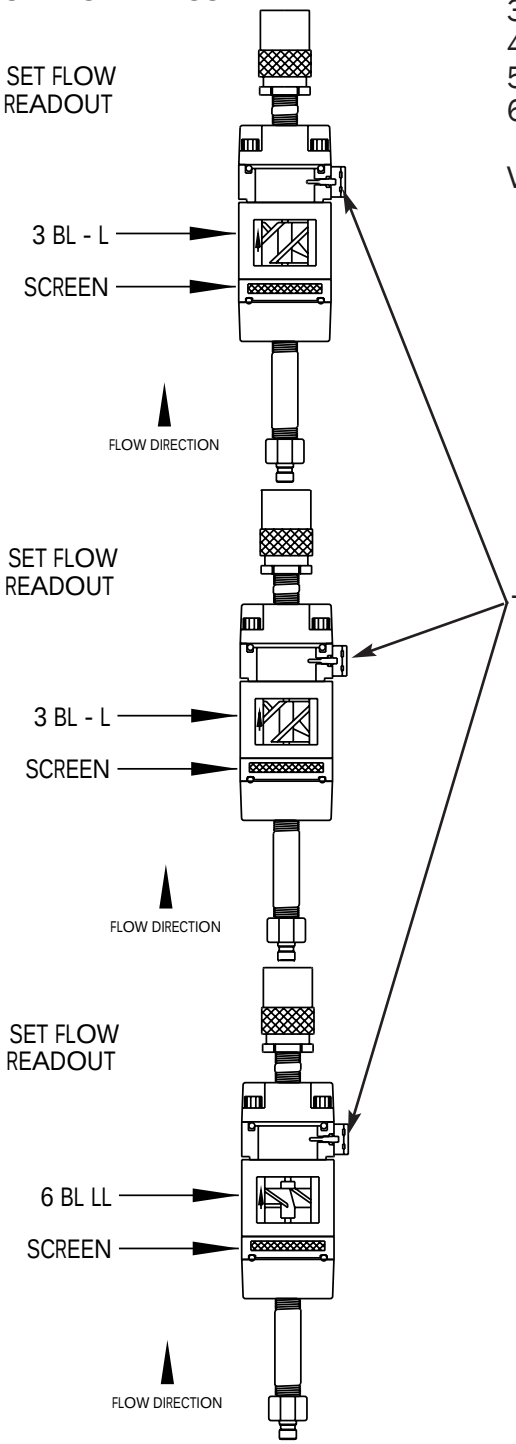
FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-2.4 GPM	1/8" X 3"	958	336	1.1	2 GPM	RTL-0202-C
.5-5.5 GPM	1/4" X 3"	1032	312	2.3	2 GPM	RTL-0404-C
.5-8 GPM	3/8" X 4"	976	330	3.6	5 GPM	RTL-0606-C
.5-10 GPM	1/2" X 4"	982	328	4.5	5 GPM	RTL-0808-C

FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-.8 GPM	1/8" X 3"	943	1950	.36	.5 GPM	RT6-0202-C
.2-3.4 GPM	1/4" X 3"	930	1978	1.5	2 GPM	RT6-0404-C
.2-4.0 GPM	3/8" X 4"	936	1964	1.8	2 GPM	RT6-0606-C

Models RCH, RCL and RC6

NOTE: TO OBTAIN CORRECT FLOW READING - USE ROTOFLOW WITH STRAIGHT INLET PIPE.
PERFORMANCE ACCURACY + - 2% REPEATABILITY < .5%

MAKE TURBINE SELECTION
1. SELECT FLOW RANGE
2. DETERMINE PIPE SIZE
3. INSTALL ASSEMBLY



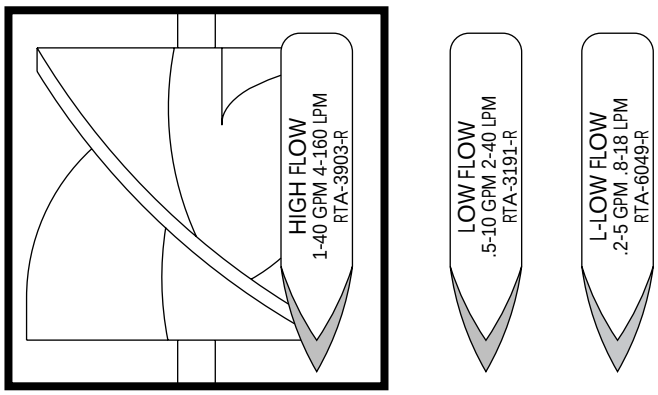
1. Check marking on TURBINE ASSEMBLY WINDOW
2. Read - HIGH FLOW SET 3 BL - H
   LOW FLOW 3 BL - L
   L- LOW FLOW 6 BL LL
3. Set **TURBINE SELECT** - on meter (see page 8)
4. Read Flow Correction (FC) on label
5. Set Flow Correction (FC) (see page 9)
6. Place pick up head on turbine and read flow

VALUES LISTED BELOW ARE FOR REFERENCE ONLY
READ LABEL ON PRODUCT

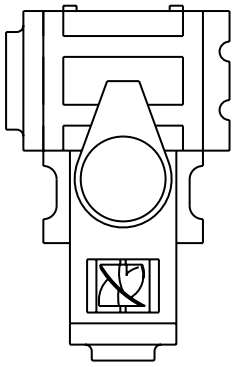
FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
1-5 GPM	1/4" X 3"	1020	220	2.5	2 GPM	RCH-0404-C
1-12 GPM	3/8" X 4"	1048	206	5.5	5 GPM	RCH-0606-C
1-22 GPM	1/2" X 4"	1000	216	10	5 GPM	RCH-0808-C
1-40 GPM	3/4" X 4"	973	222	18	10 GPM	RCH-1212-S
1-60 GPM	1" X 5"	978	220	29	10 GPM	RCH-1616-S

FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-2.4 GPM	1/8" X 3"	1095	294	1.1	2 GPM	RCL-0202-C
.5-5.5 GPM	1/4" X 3"	1062	303	2.3	2 GPM	RCL-0404-C
.5-8 GPM	3/8" X 4"	1006	320	3.6	5 GPM	RCL-0606-C
.5-10 GPM	1/2" X 4"	1000	322	4.5	5 GPM	RCL-0808-C

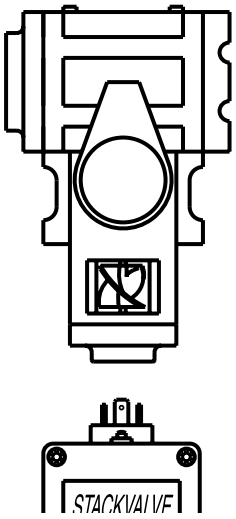
FLOW RANGE	SIZE	SET (FC)	PPG	Cv	CALIBRATION POINT	MODEL
.2-.8 GPM	1/8" X 3"	925	1989	.36	.5 GPM	RC6-0202-C
.2-3.4 GPM	1/4" X 3"	932	1974	1.5	2 GPM	RC6-0404-C
.2-4.0 GPM	3/8" X 4"	906	2031	1.8	2 GPM	RC6-0606-C



1. Check marking on TURBINE ASSEMBLY WINDOW
2. Read - HIGH FLOW SET 3 BL - H
   LOW FLOW 3 BL - L
   L- LOW FLOW 6 BL LL
3. Set **TURBINE SELECT** - on meter (see page 8)
4. Read Flow Correction (FC) on label
5. Set Flow Correction (FC) (see page 9)
6. Place pick up head on turbine and read flow



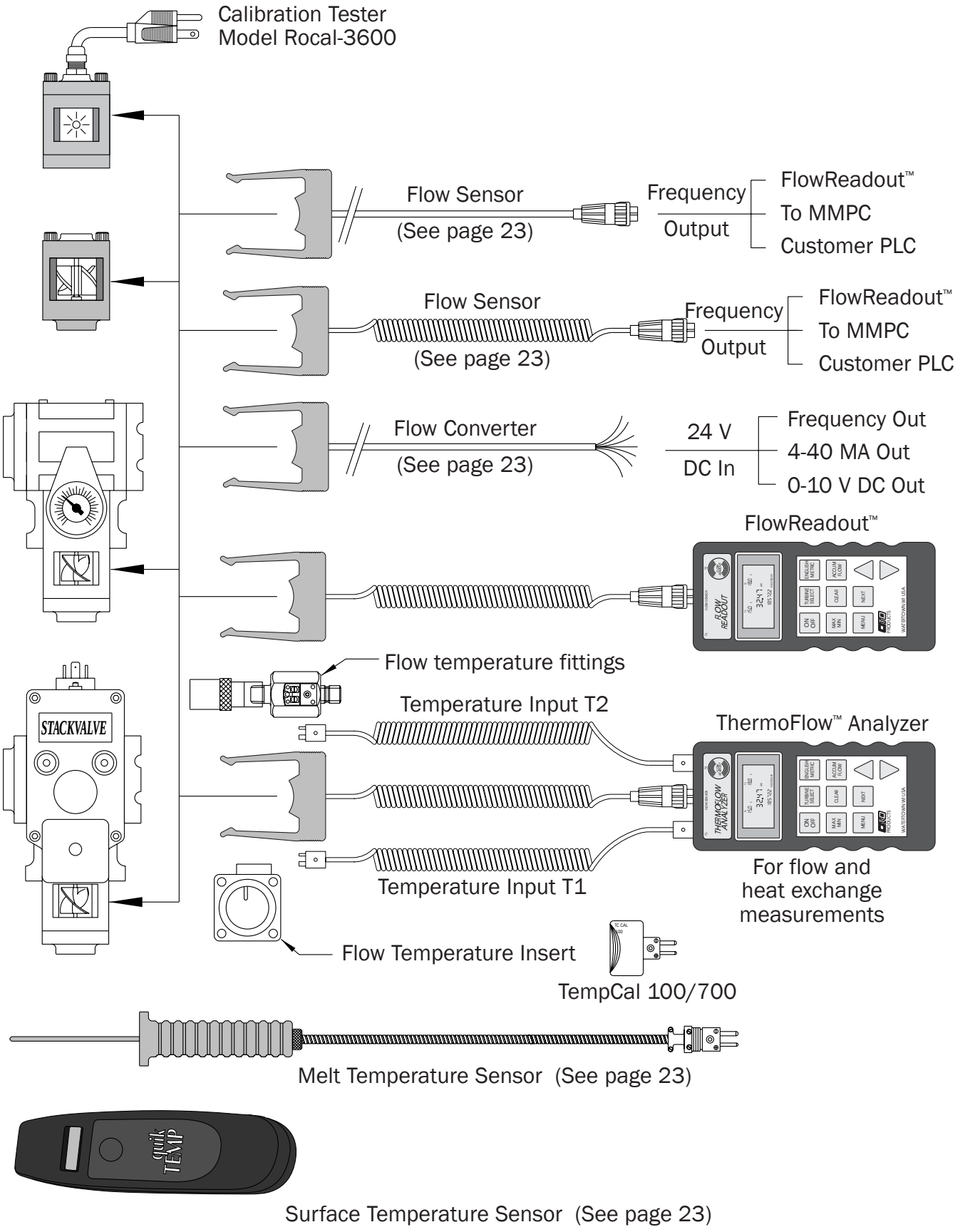
FLOW RANGE	TURBINE ASSEMBLY	METER RANGE	IN SIZE	SET (FC)	PPG	Cv	CALIBR.	MODEL
1-22 GPM	RTA-3903	3 BL - H	1/2"	939	230	7.8	5 GPM	SFA-12XX
1-40 GPM	RTA-3903	3 BL - H	3/4"	931	232	10.8	10 GPM	SFA-13XX
1-40 GPM	RTA-3903	3 BL - H	1"	923	234	13.0	10 GPM	SFA-14XX
.5-10 GPM	RTA-3191	3 BL - L	1/2"	990	325	4.1	5 GPM	SFA-12XX
.5-10 GPM	RTA-3191	3 BL - L	3/4"	992	319	4.6	10 GPM	SFA-13XX
.5-10 GPM	RTA-3191	3 BL - L	1"	994	320	4.8	10 GPM	SFA-14XX
.2-4 GPM	RTA-6051	6 BL LL	1/2"	940	1956	1.7	5 GPM	SFA-12XX
.2-4 GPM	RTA-6051	6 BL LL	3/4"	938	1960	1.8	10 GPM	SFA-13XX
.2-4 GPM	RTA-6051	6 BL LL	1"	937	1962	1.8	10 GPM	SFA-14XX



FLOW RANGE	TURBINE ASSEMBLY	METER RANGE	IN SIZE	SET (FC)	PPG	Cv	CALIBR.	MODEL
1-22 GPM	RTA-3903	3 BL - H	1/2"	986	223	7.8	5 GPM	SVA-12XX
1-40 GPM	RTA-3903	3 BL - H	3/4"	935	231	10.8	5 GPM	SVA-13XX
1-40 GPM	RTA-3903	3 BL - H	1"	923	234	13.0	5 GPM	SVA-14XX
.5-10 GPM	RTA-3191	3 BL - H	1/2"	994	324	4.1	5 GPM	SVA-12XX
.5-10 GPM	RTA-3191	3 BL - H	3/4"	1006	320	4.6	10 GPM	SVA-13XX
.5-10 GPM	RTA-3191	3 BL - H	1"	1012	318	4.8	10 GPM	SVA-14XX
.2-4 GPM	RTA-6051	6 BL LL	1/2"	970	1896	1.5	2 GPM	SVA-12XX
.2-4 GPM	RTA-6051	6 BL LL	3/4"	988	1862	1.6	2 GPM	SVA-13XX
.2-4 GPM	RTA-6051	6 BL LL	1"	992	1854	1.6	2 GPM	SVA-14XX

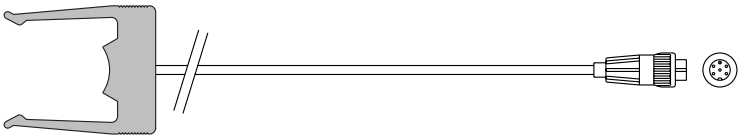
WHEN ASSEMBLING WITH OTHER THAN STANDARD PIPE SIZES, FLOW RATE IS SUBJECT TO CHANGE. CHECK FLOW RATE WITH A CERTIFIED **ROTOFLOW™** IN LINE AND SET NEW FLOW CORRECTION (FC). FOR DETAIL SEE PAGE 9, 27, AND 28.

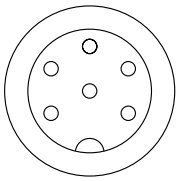
Sensor Options and Connections



Sensor Description and Connection

Flow Sensor (Cable)





1 SIGNAL
2-6 GROUND
4-5 POS
3 NO CONNECTION

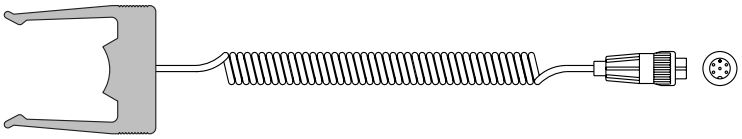
TO CHECK:

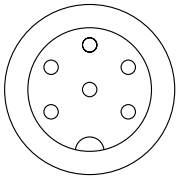
FSA I 04 M06

- CONNECTOR # - 000 = LONG PIG LEADS ROJ 3" STRIP 1/4"
  M06 = MALE 6 CONDUCTOR MALE (CONXALL #6-282-6PG-519)
- CABLE LENGTH IN INCHES
- TYPE OF SENSOR - I = INFRARED, M = MAGNETIC
- FLOW SENSOR ASSEMBLY

APPLY 5 V DC
READ APPROXIMATE 1 V WHEN LIGHT IS PRESENT
READ < .1 V WHEN DARK

Flow Sensor (Coiled)





1 SIGNAL
2-6 GROUND
4-5 POS
3 NO CONNECTION

TO CHECK:

APPLY 5 V DC
READ APPROXIMATE 1 V WHEN LIGHT IS PRESENT
READ < .1 V WHEN DARK

FSA I C30 M06

- CONNECTOR # - 000 = LONG PIG LEADS ROJ 3" STRIP 1/4"
  M06 =MALE 6 CONDUCTOR (CONXALL #6-282-6PG-519)
- CABLE LENGTH IN INCHES
- TYPE OF SENSOR - I = INFRARED, M = MAGNETIC
- FLOW SENSOR ASSEMBLY

Melt Temperature Sensor

MPA–4–60–K

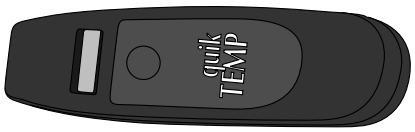
- "K" TYPE THERMOCOUPLE
- 60" LONG ARMORED CABLE
- 1/8" DIA SENSOR
- MELT PROBE ASSEMBLY

TO CHECK:

CHECK RESISTANCE TERMINALS
FOR OPEN CIRCUIT

PLACE SENSOR IN TC CALIBRATOR
AND CHECK AT 100° FAHRENHEIT
CHECK AT 500° FAHRENHEIT

Surface Temperature Sensor



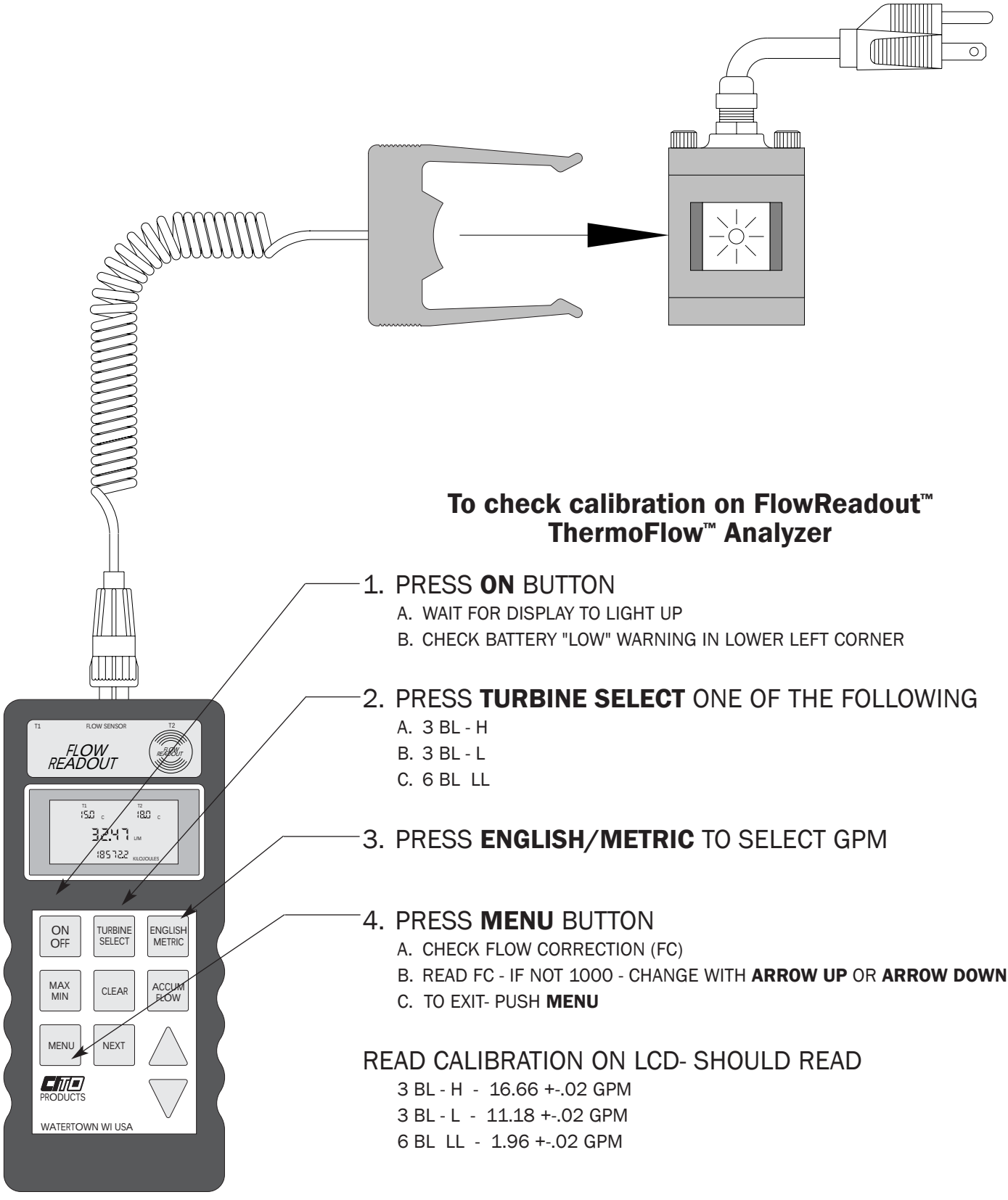
STA–250–K

- "K" TEMPERATURE RANGE
- 250° F CALIBRATION RANGE
- INFRARED TEMPERATURE SENSOR

TO CHECK:

PLACE SENSOR IN TC CALIBRATOR
AND CHECK AT 100° FAHRENHEIT
CHECK AT 500° FAHRENHEIT

Model Rocal-3600



To check calibration on FlowReadout™ ThermoFlow™ Analyzer

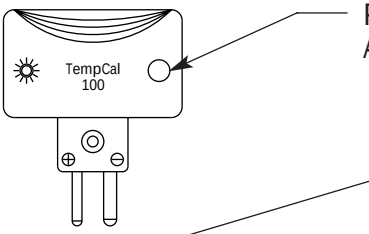
1. PRESS **ON** BUTTON
   - A. WAIT FOR DISPLAY TO LIGHT UP
   - B. CHECK BATTERY "LOW" WARNING IN LOWER LEFT CORNER
2. PRESS **TURBINE SELECT** ONE OF THE FOLLOWING
   - A. 3 BL - H
   - B. 3 BL - L
   - C. 6 BL LL
3. PRESS **ENGLISH/METRIC** TO SELECT GPM
4. PRESS **MENU** BUTTON
   - A. CHECK FLOW CORRECTION (FC)
   - B. READ FC - IF NOT 1000 - CHANGE WITH **ARROW UP** OR **ARROW DOWN**
   - C. TO EXIT- PUSH **MENU**

READ CALIBRATION ON LCD- SHOULD READ

- 3 BL - H - 16.66 +-.02 GPM
- 3 BL - L - 11.18 +-.02 GPM
- 6 BL LL - 1.96 +-.02 GPM

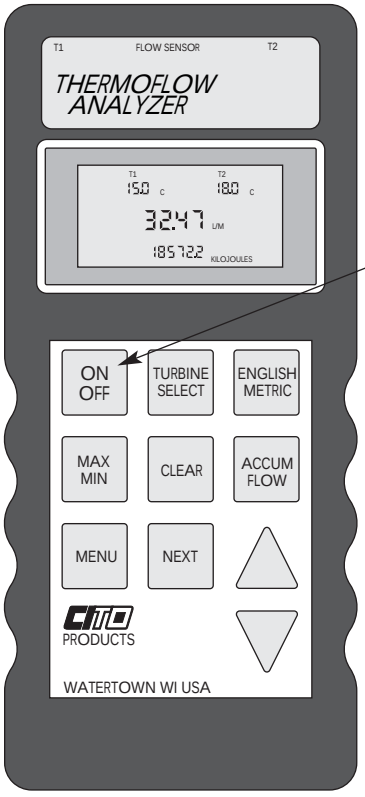
To check absolute temperature calibration on ThermoFlow™ Analyzer use Models TempCal-100 and TempCal-700

PLUG IN CALIBRATOR TC FEMALE CONNECTOR



PUSH CAL BUTTON - FOR LED BATTERY TEST
AND HOLD DURING CALIBRATION TEST

1. Insert **TempCal 100** and calibrate to 100° F.
   Insert **TempCal 700** and calibrate to 700° F.
   (OR "K" Couple Sensor In Known Temperature Bath)



2. PRESS **ON** BUTTON

A. WAIT FOR DISPLAY TO LIGHT UP

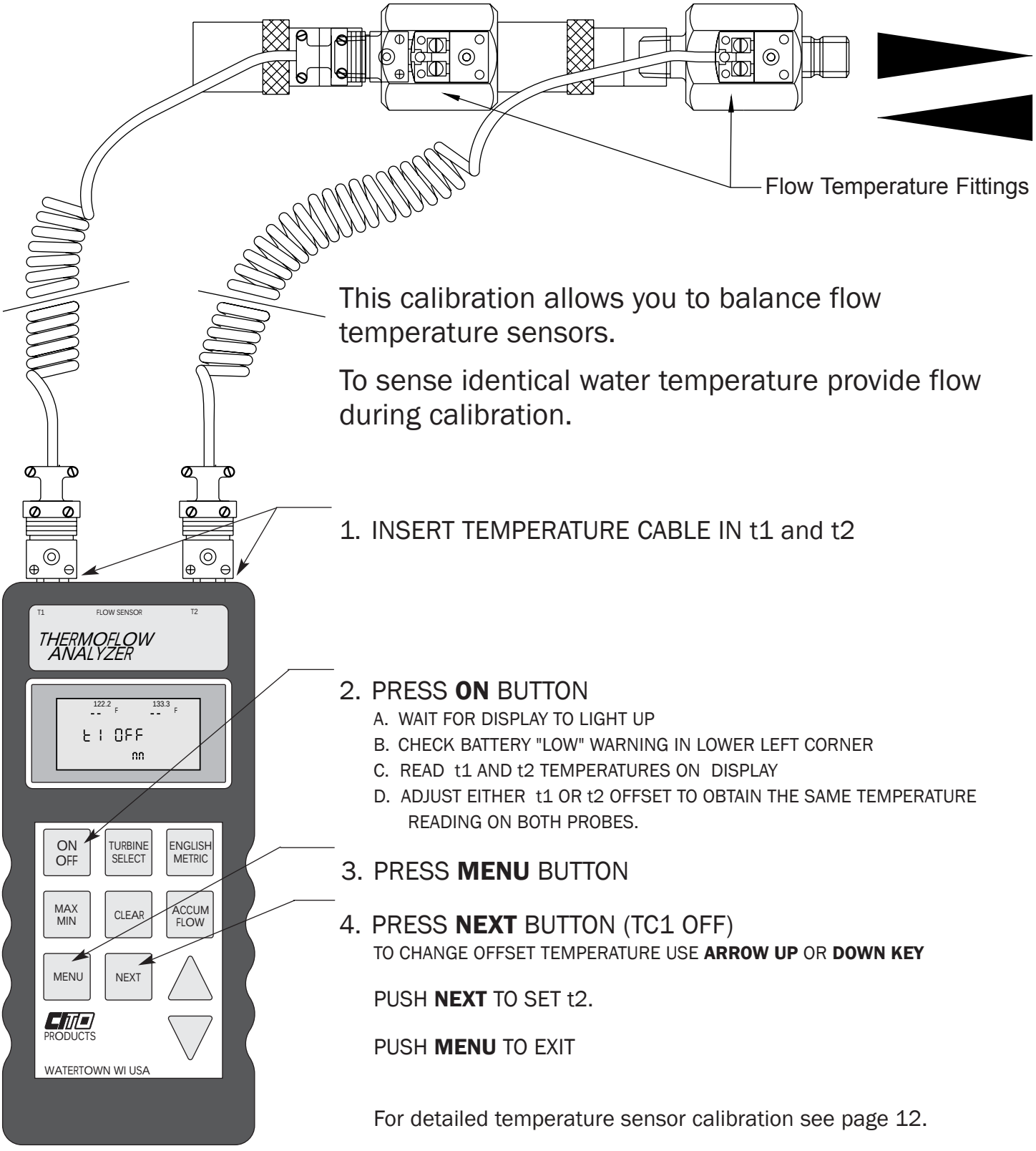
B. CHECK BATTERY "LOW" WARNING IN LOWER LEFT CORNER

C. READ t1 TEMPERATURE ON DISPLAY

D. TEMPERATURE MUST READ CORRECT VALUE
   TEMPCAL-100 MUST READ 100°F (+ - .5°F)
   TEMPCAL-700 MUST READ 700°F (+ - .5°F)

E. IF INCORRECT, RETURN TO FACTORY FOR CALIBRATION.

Use Temperature Coupling



This calibration allows you to balance flow temperature sensors.

To sense identical water temperature provide flow during calibration.

1. INSERT TEMPERATURE CABLE IN t1 and t2

2. PRESS **ON** BUTTON
   - A. WAIT FOR DISPLAY TO LIGHT UP
   - B. CHECK BATTERY "LOW" WARNING IN LOWER LEFT CORNER
   - C. READ t1 AND t2 TEMPERATURES ON DISPLAY
   - D. ADJUST EITHER t1 OR t2 OFFSET TO OBTAIN THE SAME TEMPERATURE READING ON BOTH PROBES.

3. PRESS **MENU** BUTTON

4. PRESS **NEXT** BUTTON (TC1 OFF)

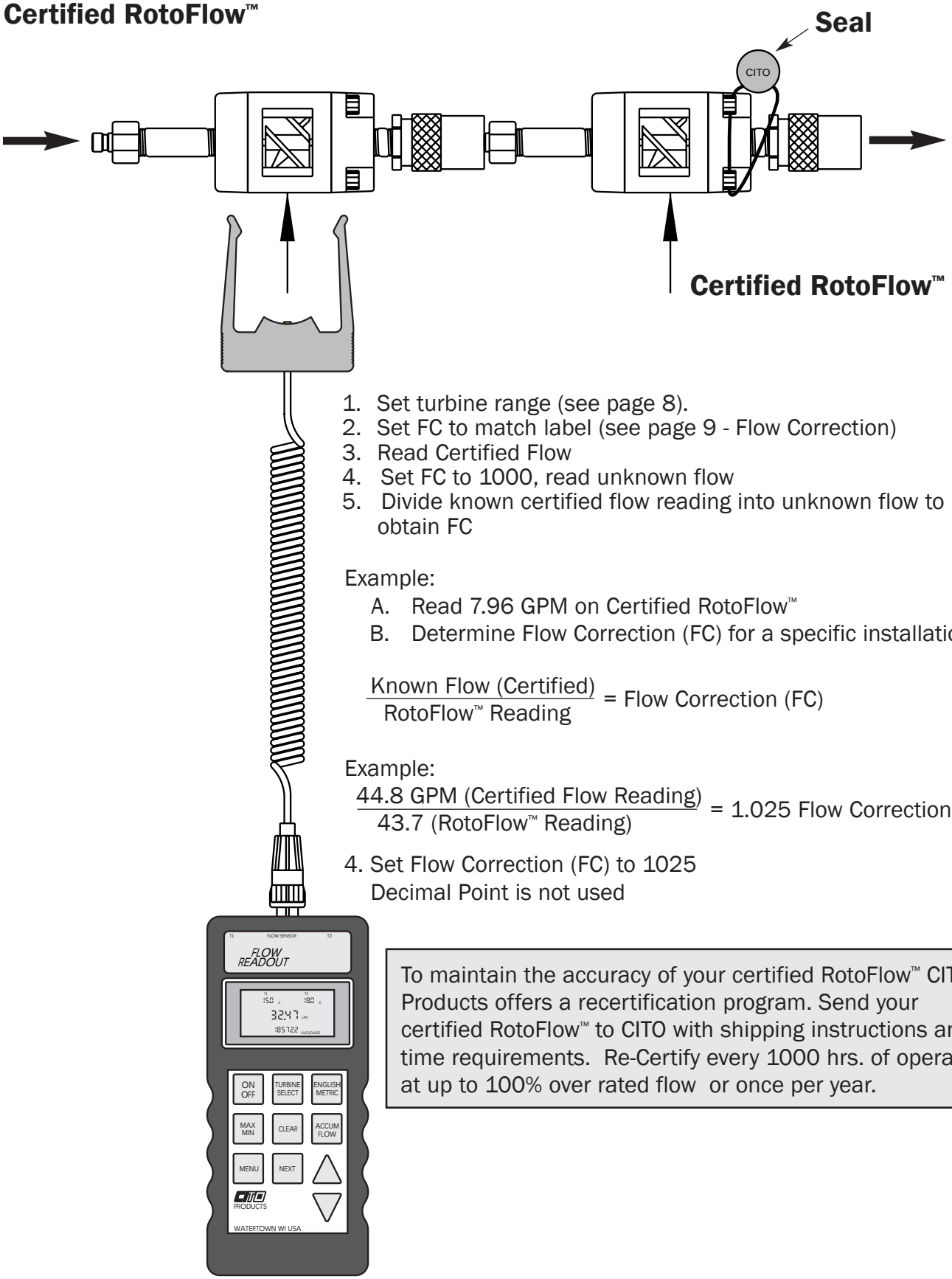
   TO CHANGE OFFSET TEMPERATURE USE **ARROW UP** OR **DOWN KEY**

   PUSH **NEXT** TO SET t2.

   PUSH **MENU** TO EXIT

For detailed temperature sensor calibration see page 12.

Use Certified RotoFlow™



1. Set turbine range (see page 8).
2. Set FC to match label (see page 9 - Flow Correction)
3. Read Certified Flow
4. Set FC to 1000, read unknown flow
5. Divide known certified flow reading into unknown flow to obtain FC

Example:

A. Read 7.96 GPM on Certified RotoFlow™
B. Determine Flow Correction (FC) for a specific installation

$$\frac{\text{Known Flow (Certified)}}{\text{RotoFlow™ Reading}} = \text{Flow Correction (FC)}$$

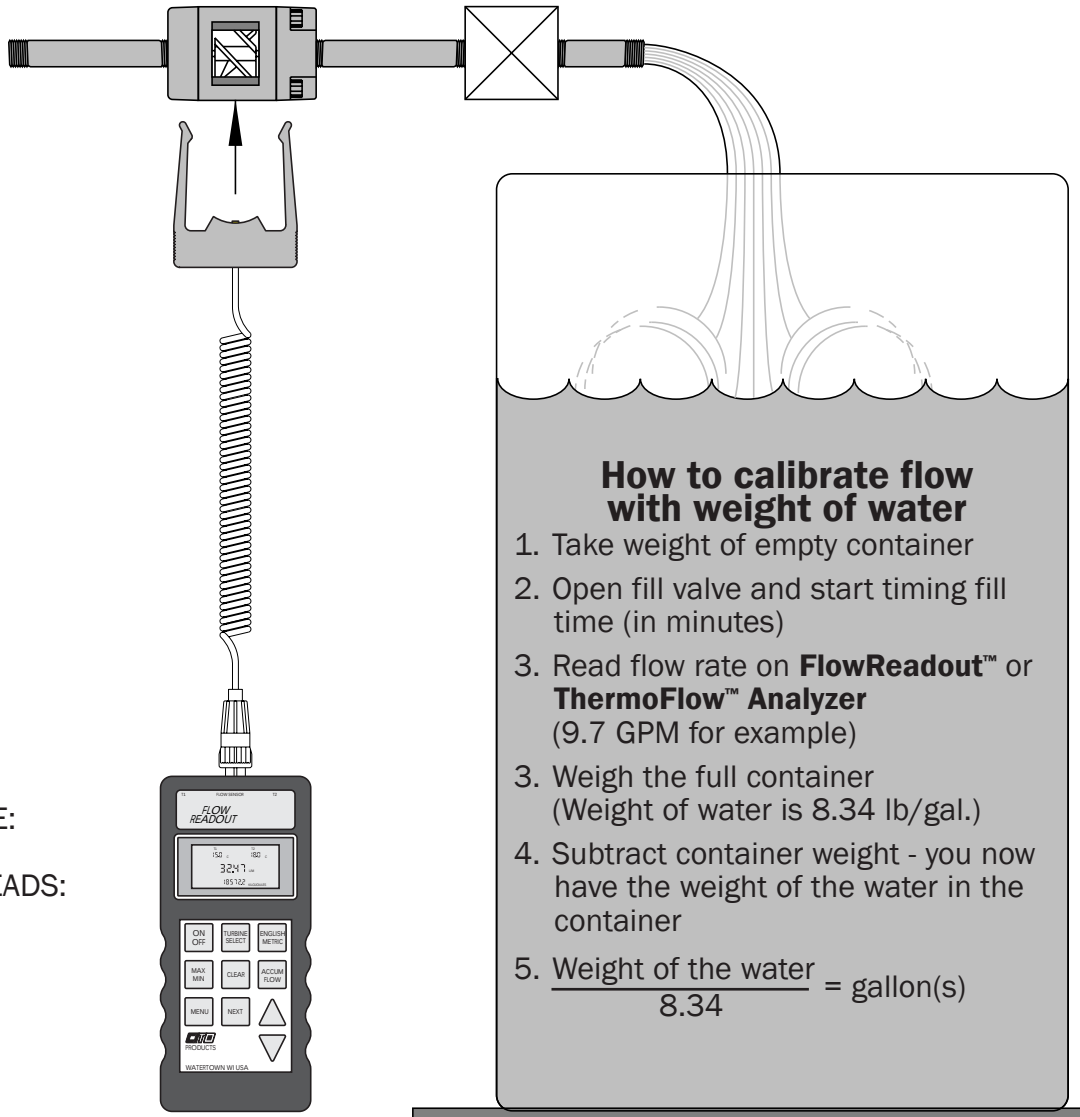
Example:

$$\frac{\text{44.8 GPM (Certified Flow Reading)}}{\text{43.7 (RotoFlow™ Reading)}} = \text{1.025 Flow Correction (FC)}$$

4. Set Flow Correction (FC) to 1025
   Decimal Point is not used

To maintain the accuracy of your certified RotoFlow™ CITO Products offers a recertification program. Send your certified RotoFlow™ to CITO with shipping instructions and time requirements. Re-Certify every 1000 hrs. of operation at up to 100% over rated flow or once per year.

Flow Calibration by Weight



EXAMPLE:

FLOW READS:
9.7 GPM

IMPORTANT!

1. Select flow range by pressing **TURBINE SELECT** - read window
   3BL- H THREE BLADE HIGH
   3BL - L THREE BLADE LOW
   6BL LL SIX BLADE LOW
   For detail on Turbine Selection (see page 8).
2. Set Flow Correction (FC) TO 1000 (see page 9).
3. Read flow rate - example 9.7 GPM. Fill container and measure fill time.
4. Calculate the weight of water.
5. Set new FC and read flow in GPM.

EXAMPLE: A container fill time is 6 minutes-44 seconds ((44/60) =.733)

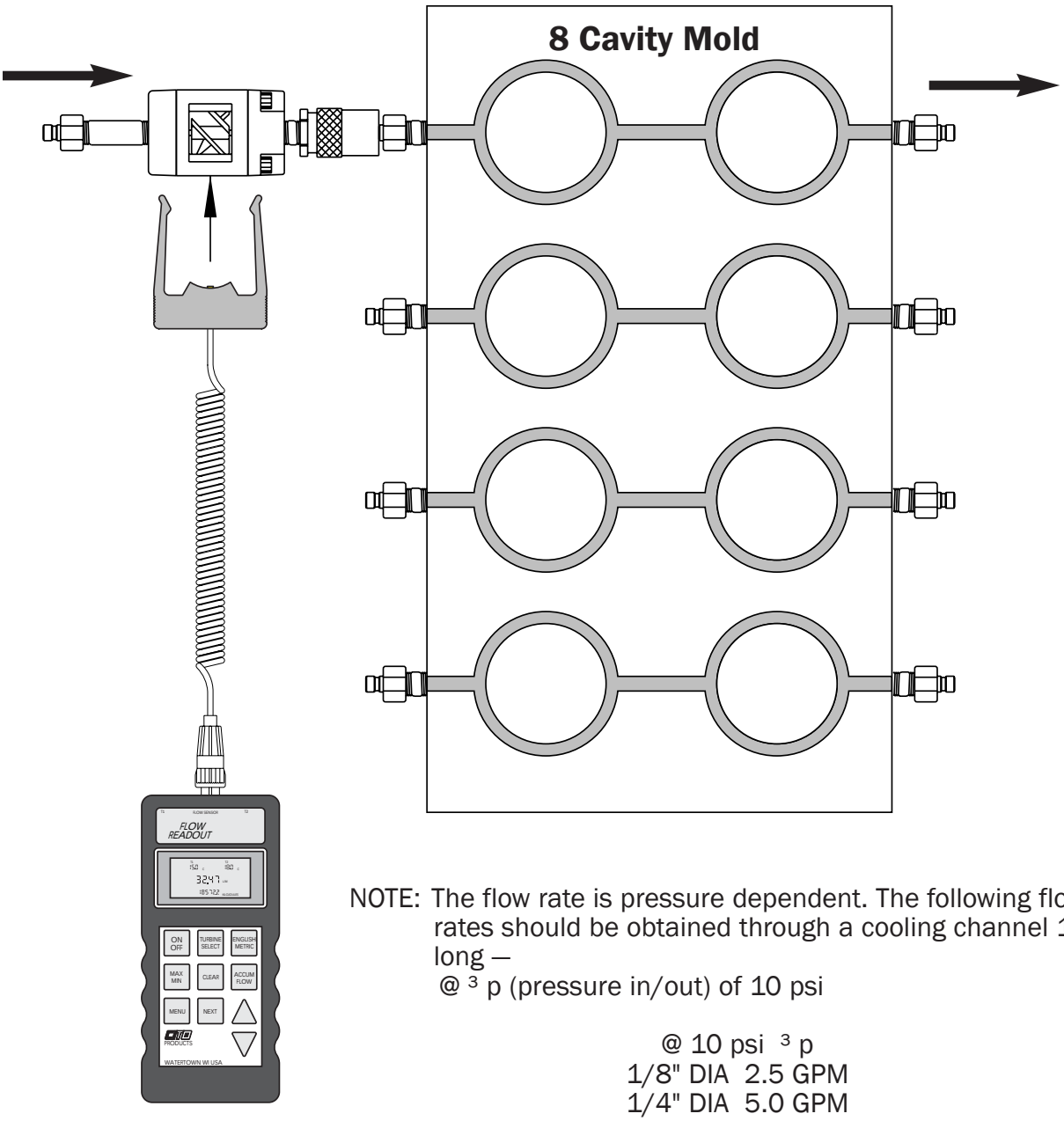
Total Container Fill Time = 6.733 minutes
Weight of Water = 429.41 lbs

$\frac{429.4\text{lbs.}}{8.34}$ = 51.48 GAL. $\frac{51.48}{6.733}$ = 7.64 GPM

6. Determine Flow Correction (FC) on **FlowReadout™** or **ThermoFlow™ Analyzer**.
   $\frac{\text{Known Flow is 7.64 GPM}}{\text{Reading of FlowReadout™ is 9.7}}$ = Flow Correction (FC) is .787
7. Set (FC) to 787 — the decimal point is not used.

Flow Test-Mold Cooling Channel

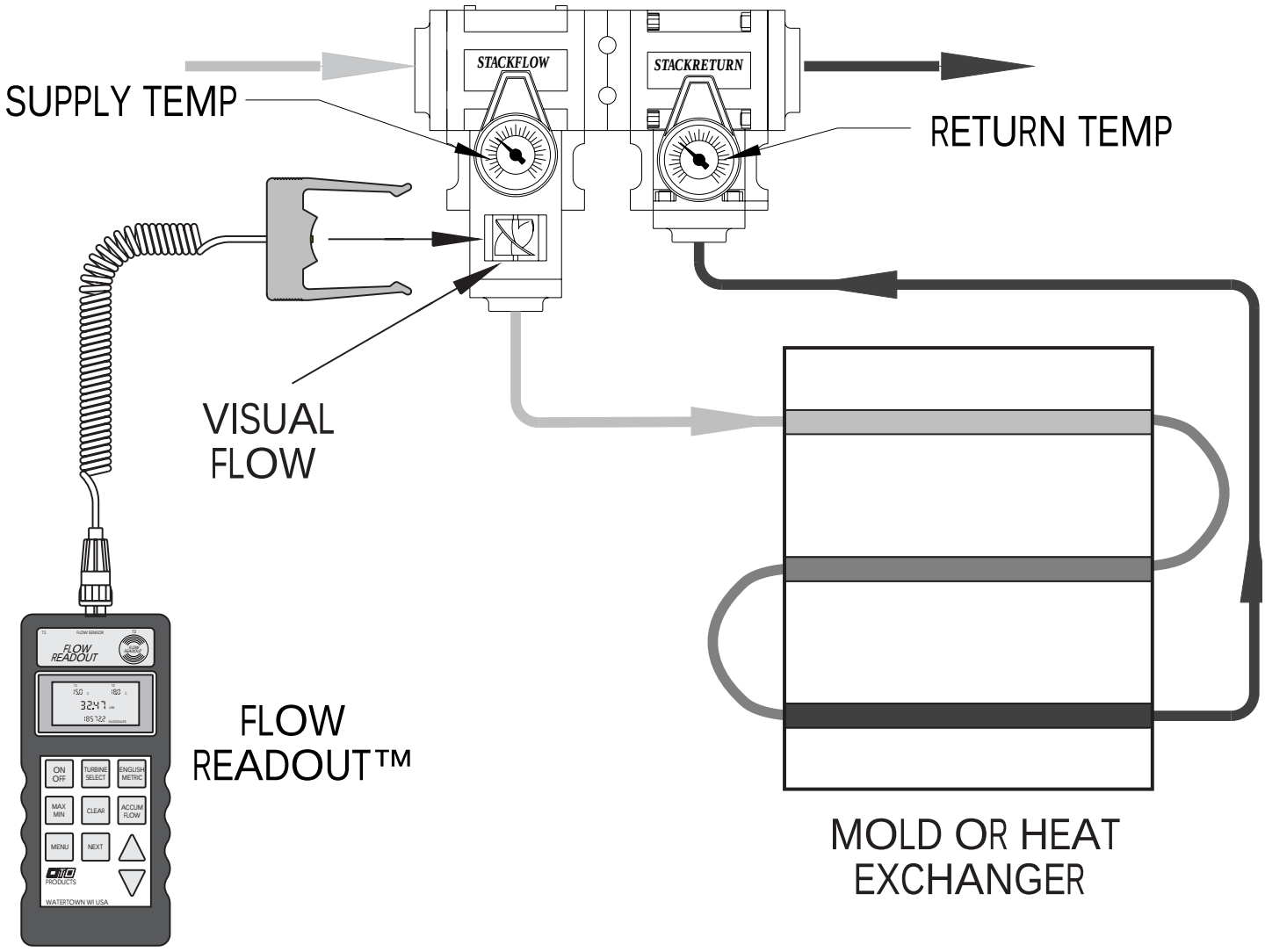
1. Connect RotoFlow™ to a water connection
2. Read flow rate through each cooling circuit
3. Flow rate should not vary - if cooling passages are the same.



NOTE: The flow rate is pressure dependent. The following flow rates should be obtained through a cooling channel 10" long —
@ ^{3} p (pressure in/out) of 10 psi

@ 10 psi ^{3} p
1/8" DIA 2.5 GPM
1/4" DIA 5.0 GPM
3/8" DIA 12 GPM
1/2" DIA 20 GPM

Check Flow Rate through StackFlow™



1. Select flow range by pressing **TURBINE SELECT** - read flow information on window.
   3BL- H THREE BLADE HIGH
   3BL - L THREE BLADE LOW
   6BL LL SIX BLADE LOW
   For detail on Turbine Selection see page 8.
2. Read Flow Correction (FC) on label of StackFlow™, StackValve™, StackController™ (see page 21).
3. Set Flow Correction (FC) on **FlowReadout™** or **ThermoFlow™ Analyzer**.

   (To calibrate to a known flow see page 9.)

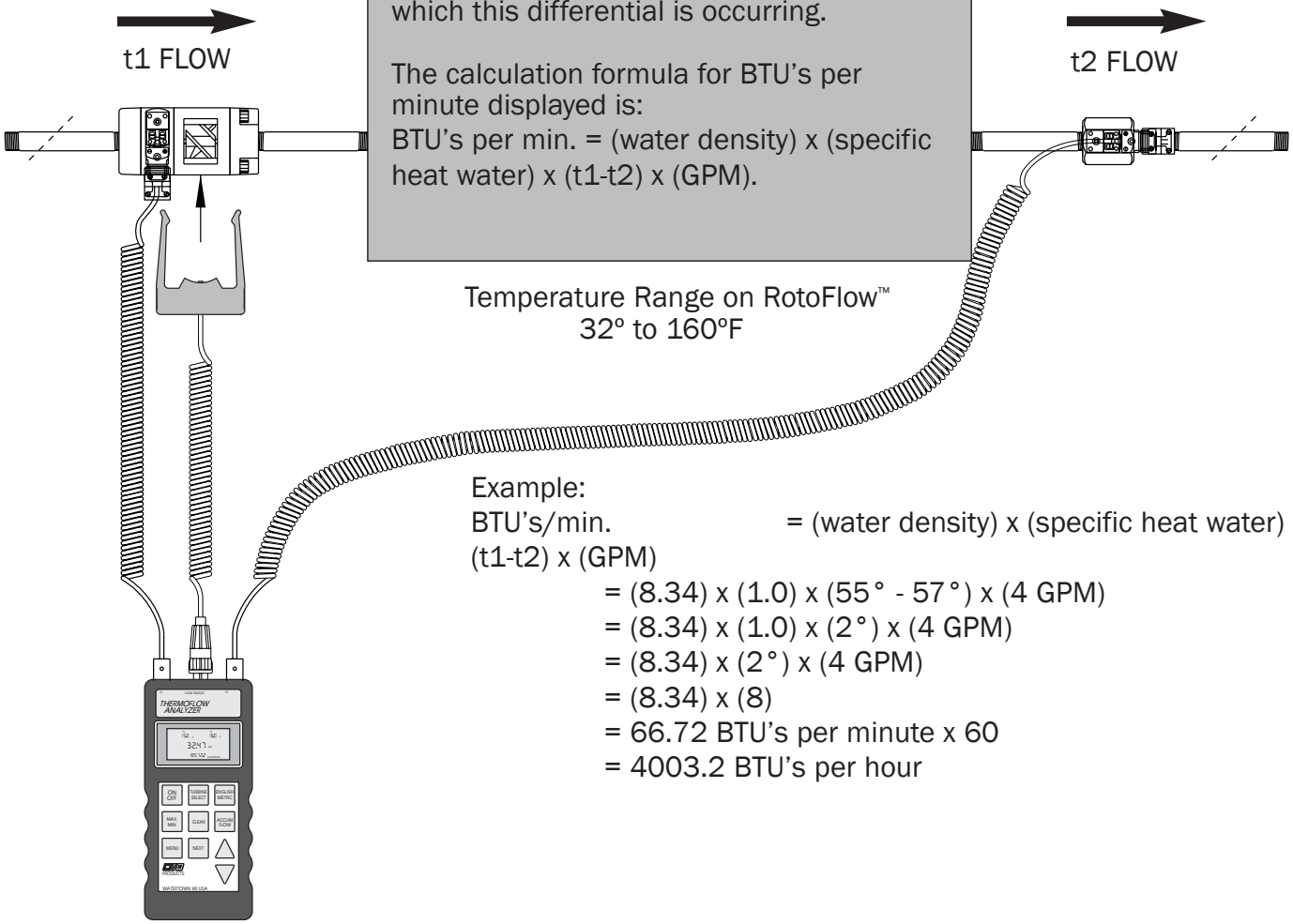
Heat Transfer Through Boiler

Boiler, Furnace or Heat Pump

Your **ThermoFlow™ Analyzer** will automatically calculate the energy being removed or added whenever t1, t2, and Flow inputs are recognized by the internal computer. It will calculate the energy value and display the value, either in English or Metric units, at the bottom center of the display.

Energy (BTU) calculation requires the monitoring of water temperature flowing into a heat exchanger, the flow (GPM) through the heat exchanger, and the water temperature exiting the heat exchanger. This data provides the internal computer with the temperature differential between input and output water and the flow rate at which this differential is occurring.

The calculation formula for BTU's per minute displayed is:
BTU's per min. = (water density) x (specific heat water) x (t1-t2) x (GPM).



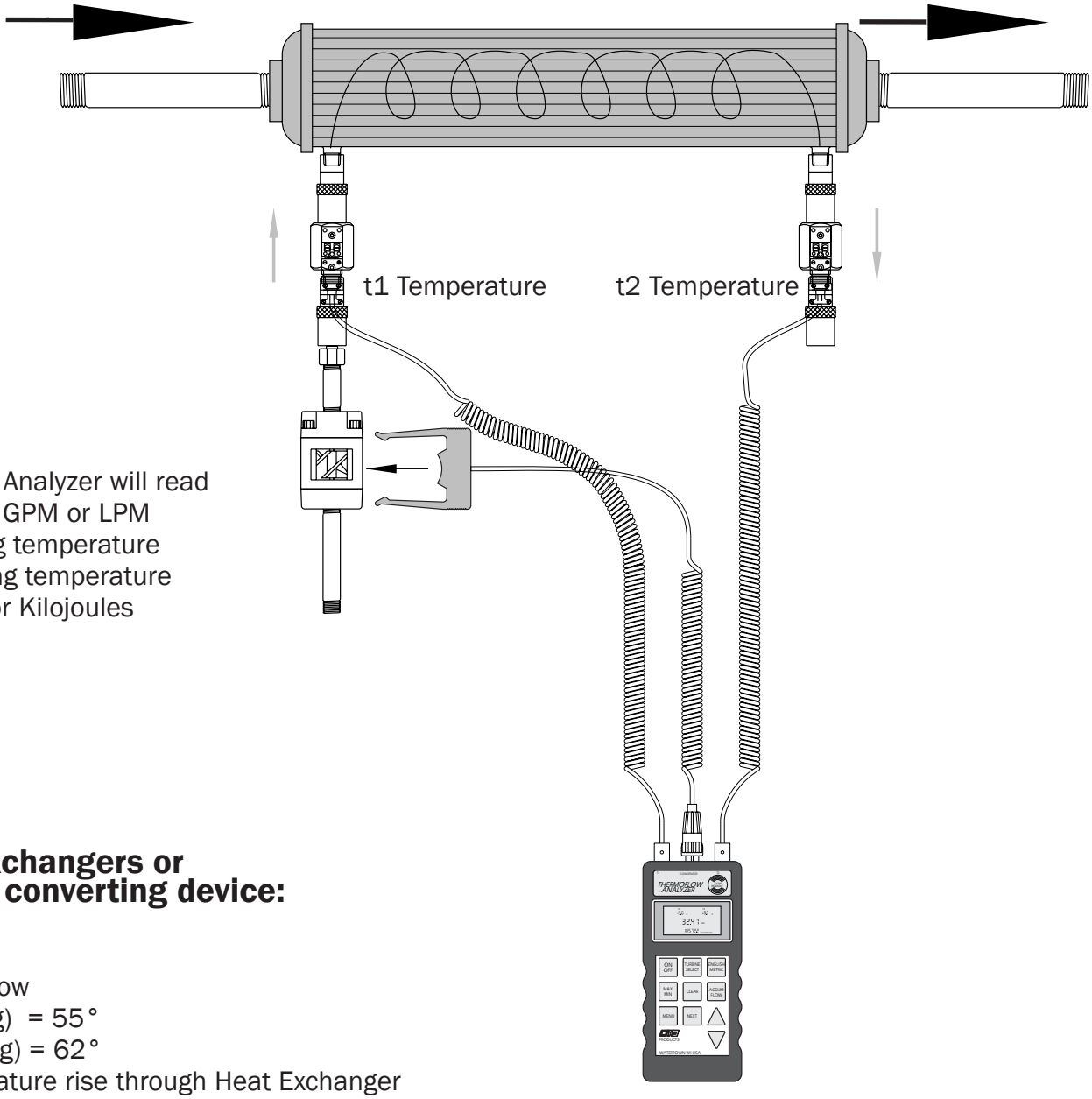
Temperature Range on RotoFlow™
32° to 160°F

Example:
BTU's/min. = (water density) x (specific heat water) x (t1-t2) x (GPM)
= (8.34) x (1.0) x (55° - 57°) x (4 GPM)
= (8.34) x (1.0) x (2°) x (4 GPM)
= (8.34) x (2°) x (4 GPM)
= (8.34) x (8)
= 66.72 BTU's per minute x 60
= 4003.2 BTU's per hour

Heat Transfer through Heat Exchanger (BTU or Kilojoules)

Your **ThermoFlow™ Analyzer** will automatically calculate the energy being removed or added whenever Flow input and t1 and t2 are recognized by the internal computer. The **ThermoFlow™ Analyzer** will calculate the energy value and display the value, either in English or Metric units (BTUs or Kilojoules), at the bottom center of the display. The calculation formula for BTU's per minute displayed is:

BTU's per min = (water density) x (specific heat of water) x (t1-t2) x (GPM)



ThermoFlow™ Analyzer will read

A. Flow in GPM or LPM
B. In going temperature
C. Outgoing temperature
D. BTU's or Kilojoules

For heat exchangers or any energy converting device:

Example:

4.4 GPM flow
t1 (in going) = 55°
t2 (outgoing) = 62°
7° temperature rise through Heat Exchanger

Calculation example:

BTU's= (water density) x (specific heat water) x (t1-t2) x (GPM)
= (8.34) x (1.0) x (55° - 62°) x (4.4 GPM)
= 256.872 BTU's per minute x 60
= 15,412 BTU's per hour

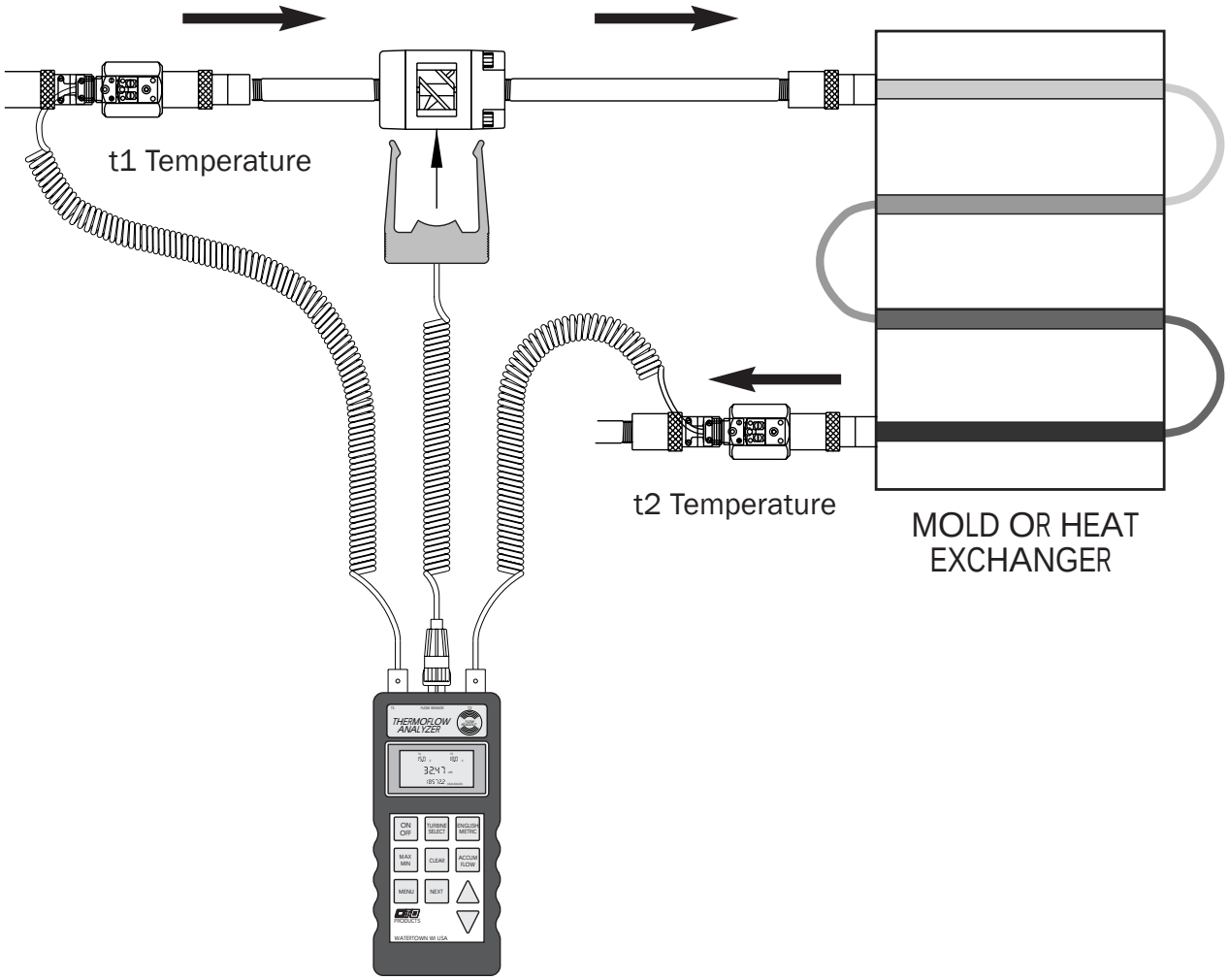
Energy Calculations of Molding Process

Your **ThermoFlow™ Analyzer** will automatically calculate the energy being removed or added whenever t1, t2, and Flow inputs are recognized by the internal computer. It will calculate the energy value and display the value, either in English or Metric units (BTUs or Kilojoules), at the bottom center of the display.

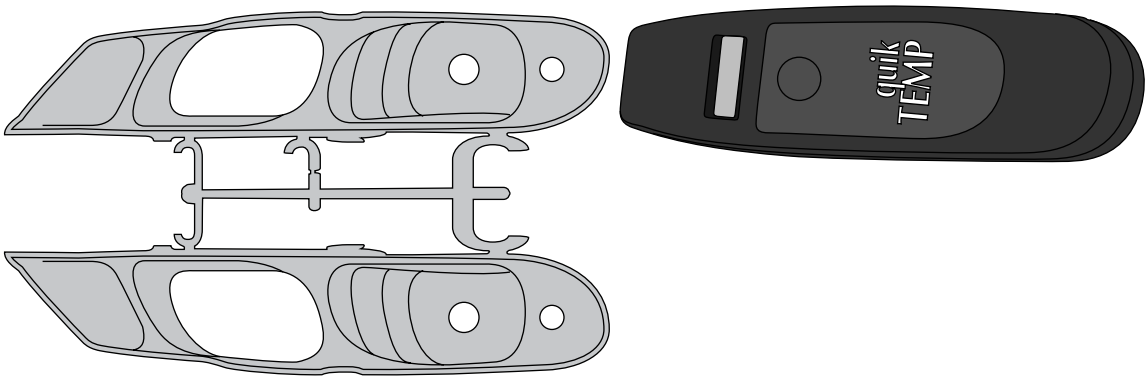
Energy (BTU) calculation requires the monitoring of water temperature flowing into a heat exchanger (mold), the flow (GPM) through the heat exchanger, and the water temperature exiting the heat exchanger. This data provides the internal computer with the temperature differential between input and output water and the flow rate at which this differential is occurring.

The calculation formula for BTU's per minute displayed is:
BTU's per min. = (water density) x (specific heat water) x (t1-t2) x (GPM)

Example calculation:
BTU's/min = (water density) x (specific heat water) x (t1-t2) x (GPM)
= (8.34) x (1.0) x (55° - 57°) x (4 GPM)
= 66.72 BTU's per minute x 60
= 4003.2 BTU's per hour

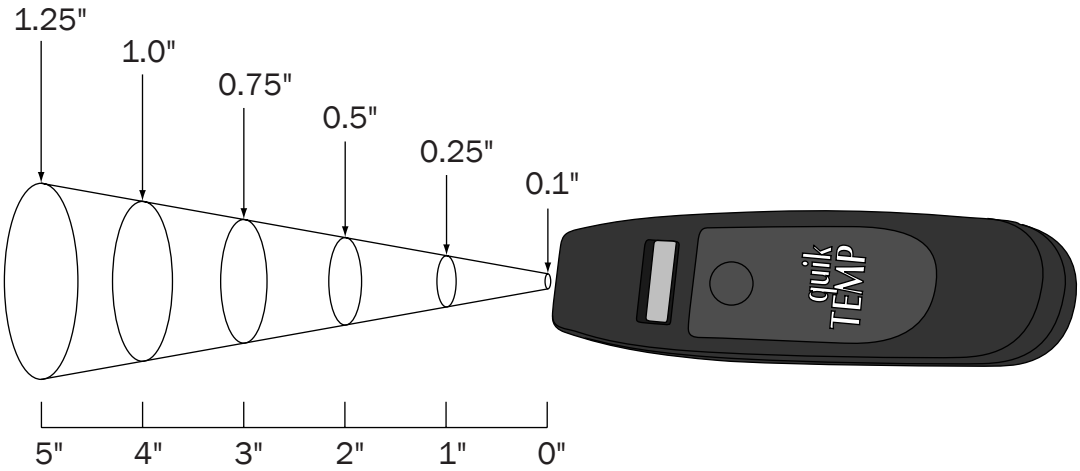


Surface Temperature Sensor (see page 23)



Operation: Turn on Power and Read Temperature

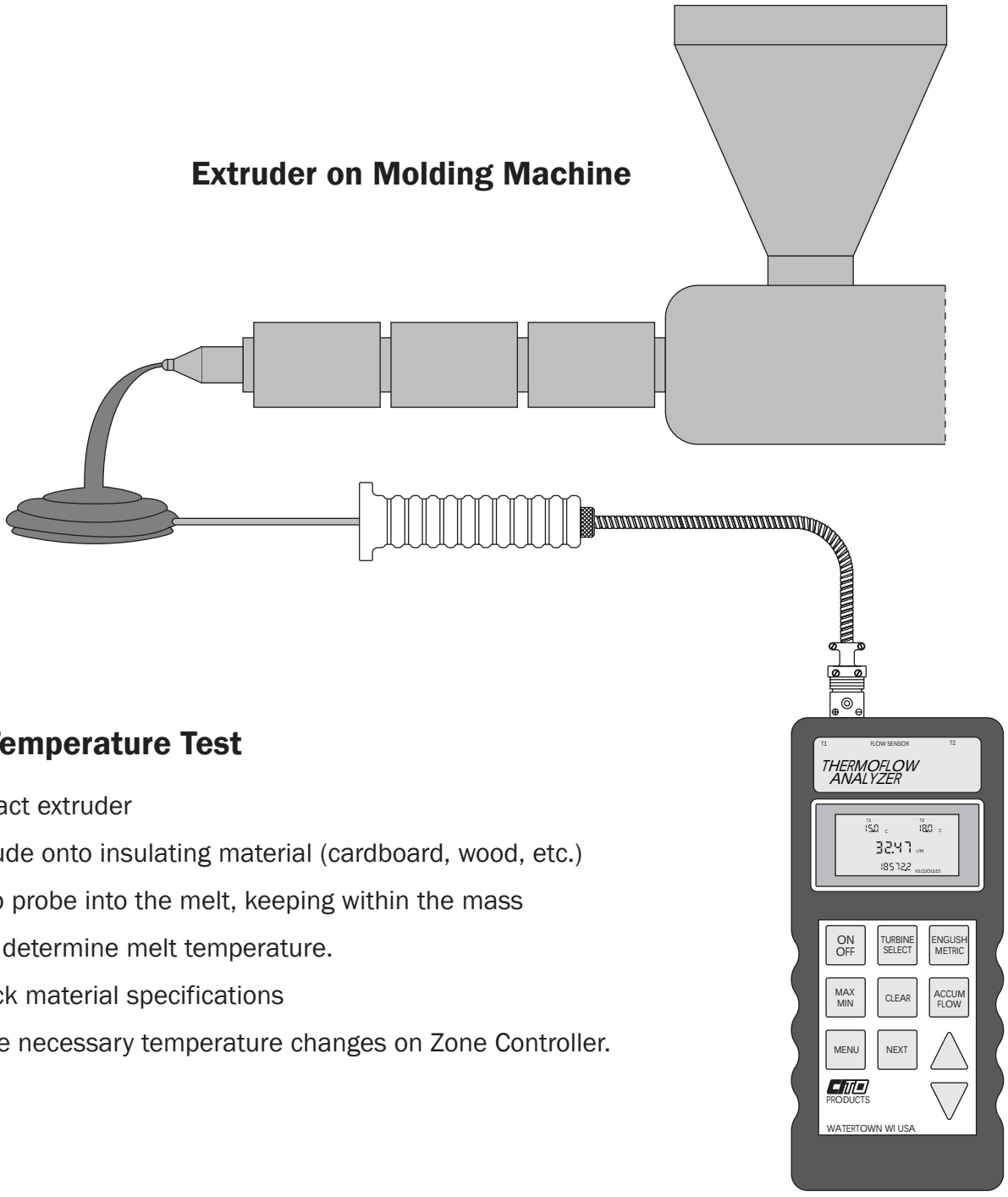
Diameter of surface of object being read



Distance from object

SPECIFICATION:	Temperature Range	0–500° F
	Output Accuracy	+- 2% of reading @81° F Ambient Operating Temperature
	Repeatability	+-1% of reading
	Response Time	1 second
	Ambient Operating Temperature	32 to 150° F
	Relative Humidity	10-95 % RH up to 86° F
	Storage	-13 - 158° F
	Power	9 V Alkaline Battery
	Battery Life	50 Hours @ 73° F

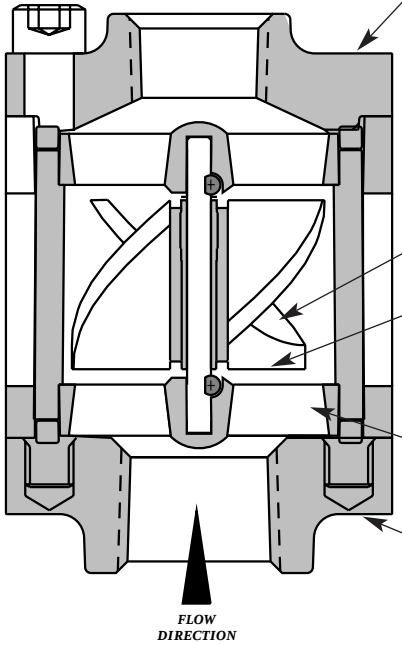
Melt Temperature Sensor (see page 23)



Melt Temperature Test

1. Retract extruder
2. Extrude onto insulating material (cardboard, wood, etc.)
3. Stab probe into the melt, keeping within the mass and determine melt temperature.
4. Check material specifications
5. Make necessary temperature changes on Zone Controller.

Turbine Assembly and Maintenance



SF-3041 1/8" OUTLET END CAP
SF-3034 1/4" OUTLET END CAP
SF-20283/8" OUTLET END CAP
SF-3025 1/2" OUTLET END CAP
SF-30203/4" OUTLET END CAP
SF-3010 1" OUTLET END CAP
SF-3004 1-1/4" OUTLET END CAP

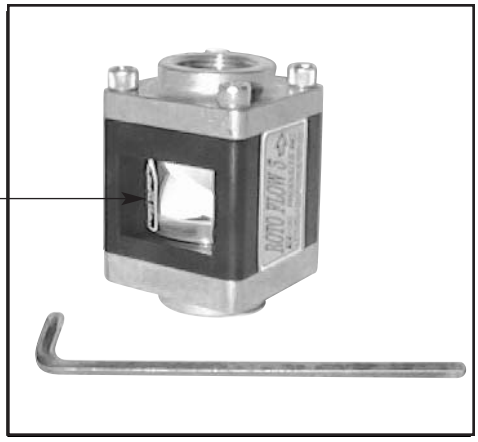
3 BLADE TURBINE **NOTE: ARROW INDICATES FLOW DIRECTION**

NOTE: SHARP EDGE ON TURBINE (INLET)

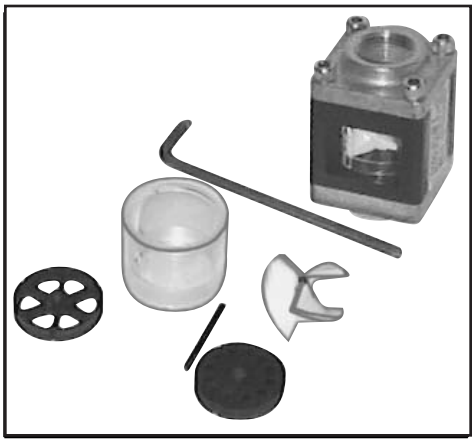
FLOW INSERT - HIGH FLOW RF-5903
LOW FLOW RF-5191

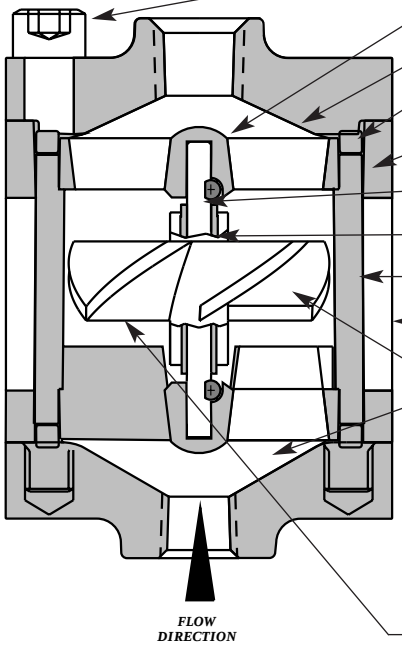
RF-3841 1/8" INLET END CAP
RF-3834 1/4" INLET END CAP
RF-28283/8" INLET END CAP
RF-3825 1/2" INLET END CAP
RF-38203/4" INLET END CAP
RF-3810 1" INLET END CAP
RF-3804 1-1/4" INLET END CAP

TO CLEAN - REMOVE 4 SHCS AND REMOVE END CAPS



NOTE: DISASSEMBLE WITH 3/16" HEX WRENCH.





3/16" SOCKET HEAD CAP SCREW
THRUST BEARING (CARBIDE)
FLOW INSERT SF-5903
221 "O" RING
BODY
TURBINE SHAFT
TURBINE BEARING
WINDOW
LABEL
6 BLADE TURBINE
FLOW INSERT RF-5051

NOTE: SHARP EDGE ON TURBINE (INLET)

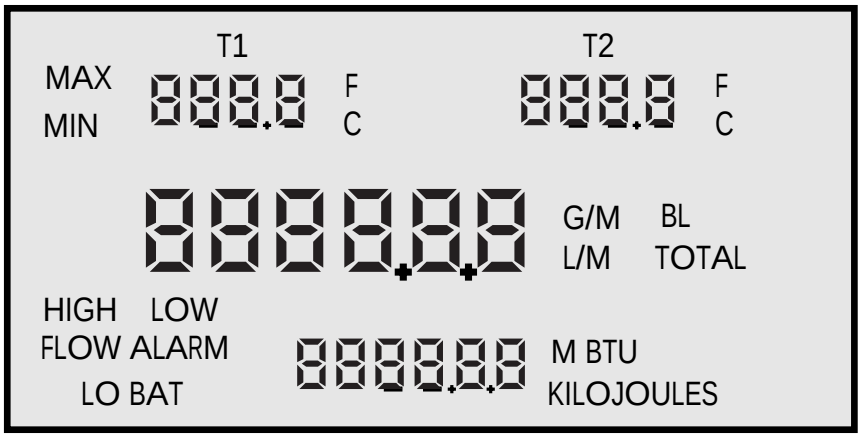
1. CLEAN PARTS WITH SOAP WATER AND REASSEMBLE
2. INSPECT BEARING COMPONENTS FOR WEAR
3. CHECK CARBIDE SHAFT DIAMETER .1247/.1249
4. CHECK ENDPAY .040 +-.005
5. IF COMPONENTS ARE DAMAGED - REPLACE ASSEMBLY

Trouble Shooting Guide

Your **FlowReadout™** and **ThermoFlow™ Analyzer** have been designed to provide years of trouble free operation and service. However, in the event a problem does arise check the following:

Read out problem:

- Low Battery (see lower left on display)
- Check all display segments
- Check for loose cable connections



Calibration Problems

- Proper setting of selection and calibration
  (see page 8 for turbine selection)
  (see page 9 for Flow Correction (FC)
- Check calibration for temperature with TempCal-100-700
- Check calibration flow Rocal-3600
- Turbine does not turn freely— clean turbine
  (see page 36)
- Display reading without Flow Sensor clipped onto RotoFlow™, StackFlow™, StackValve™ or StackController™

The Flow Sensor is an infrared device and will recognize certain ambient light wave lengths. This condition will correct itself when Flow Sensor is clipped onto turbine device. Disregard any readings when Flow Sensor is not clipped in monitoring position. To get “0” reading shield infrared pick-up from light.

If you send the units to the service department please have the following information included:

- Model Number of **FlowReadout™** or **ThermoFlow™ Analyzer**
- Serial Number of **FlowReadout™** or **ThermoFlow™ Analyzer**
- Written detailed explanation of difficulties encountered
- If you are measuring a RotoFlow™, StackFlow™, StackValve™ or StackController™
- Type of turbine being measured
- Condition of turbine
- Condition of water system

This information will assist our service technicians in solving any possible problems you may be experiencing.

For Technical Support or calibration service:

CITO Products, Inc.
N8779 Hwy. X • P.O. Box 90
Watertown, WI 53094 • USA
Phone: (920) 261-5799 • Fax: (920) 261-1350 • E-mail: sales@citoinc.com

DISCLAIMER: ALL PERFORMANCE SPECIFICATIONS ARE BASED ON CLEAN PROCESS WATER. EVERY EFFORT HAS BEEN MADE TO MAKE PRODUCT AS RELIABLE AS POSSIBLE. THE INFRARED SENSOR HAS THE ABILITY TO "SEE" THROUGH DIRTY WATER AND STILL READS CORRECT FLOW , HOWEVER, CONTAMINATION MAY LODGE IN TURBINE AND CHANGE FLOW RATE.
CITO DOES NOT GUARANTEE PERFORMANCE UNDER VARIOUS ABNORMAL FIELD CONDITIONS.

WARRANTY

We warrant our products to be free from defects in material and workmanship for a period of one year from the date of purchase.

Our liability under this warranty is limited to the repair or replacement of the product, after careful inspection by Cito Products, Inc. This warranty does not cover obvious abuse or misuse of the product.

Responsibility as to the intended use and suitability of the products rests entirely with the user.

SAFETY PRECAUTIONS TO OBSERVE WHEN USING THESE PRODUCTS

1. All care should be taken not to touch the sensor probe sheath while measuring extremely high or low temperatures, or toxic materials.

2. Shock hazards exist when sensor probes are exposed to voltages greater than 36vDC or 36v peak AC.
   Do not use where the measurement surface exceeds this voltage level.

3. No attempt should be made to measure temperatures exceeding the range of the sensor probe being used. Personal injury or sensor damage could occur.

4. Do not use any of these products inside of a microwave oven.

5. All care should be taken not to bend the sensor probe sharply. The wire may be damaged, causing the sensor to fail.

6. Before attempting to replace the battery in the **FlowReadout™** or the **ThermoFlow™ Analyzer**, please make sure the unit is off, and all sensor probes are disconnected.

Material Compatibility

Components of RotoFlow™, StackFlow™, StackValve™, and StackController™:

End Caps	360 Brass
Turbine	Acetal
Turbine Bearing	Bronze
Turbine Bearing Shaft	Tungsten Carbide
End Thrust Bearing	Tungsten Carbide
Body Housing	Nylon 6/6 50% Fiberglass
Hardware	Stainless Steel

OPERATING RANGE: 25°-160° F

PRODUCTS INC.

CITO Products, Inc.
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Watertown, WI 53094 • USA

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