INSTRUCTION MANUAL

HI839800

Hanna Instruments COD Reactor for Chemical Oxygen Demand and user-specific analysis

Hanna Instruments Inc., 584 Park East Drive, Woonsocket, RI 02895 USA
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments® product.
Please read this instruction manual carefully before using this instrument as it provides the necessary information for correct use of this instrument, as well as a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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1. PRELIMINARY EXAMINATION

Remove the instrument and accessories from the packaging and examine it carefully. For further assistance, please contact your local Hanna Instruments® office or email us at tech@hannainst.com.

Each HI839800 is supplied with:

- HI740217 Laboratory safety shield
- Power cable
- Quick reference guide with instructions for manual download and instrument quality certificate

Note: *Save all packing material until you are sure that the instrument works correctly. Any damaged or defective item must be returned in its original packing material with the supplied accessories.*

Reactor models

HI839800-01 115 Vac, USA plug
HI839800-02 230 Vac, European plug

2. SAFETY MEASURES

HOT SURFACE
DO NOT TOUCH

Touching the reactor block surfaces and vials while hot can cause serious burns.

Pay attention to all danger and caution statements. Failure to do so could result in injury to the operator or damage to the equipment. Do not use the reactor in any manner other than that which is specified in this manual.

Safety equipment	• Use care and wear suitable eye protection and clothing when operating the reactor. • Use of supplied safety shield is strongly recommended.
Reagent spills	• If a reagent spill occurs, wipe up immediately and rinse with plenty of water. • If reagent contacts skin, rinse the affected area thoroughly with water. • Avoid breathing released vapors.
Waste disposal	• Contact a licensed waste disposal provider for proper disposal of reagent vials and reacted samples.
Fire hazard	• Keep flammable liquids away from the operating reactor.

3. GENERAL DESCRIPTION

The HI839800 is a robust 25 vial capacity thermo-reactor for COD determination of industrial wastewater.
The reactor has three stored and three programmable (custom) temperature programs.
The stored programs support analysis methods at:

- 170 °C (all COD methods)
- 150 °C (all COD methods, Iron Total, Phosphorus Acid Hydrolyzable, Phosphorus Total methods)
- 105 °C (Chromium and Nitrogen Total methods)

Main Features

- Up to 180 minutes built-in countdown timer
- Indicator light for POWER (on), HOT (surface), HEATING (in progress)
- Reactor block temperature continuously evaluated and displayed
- Reference temperature probe well

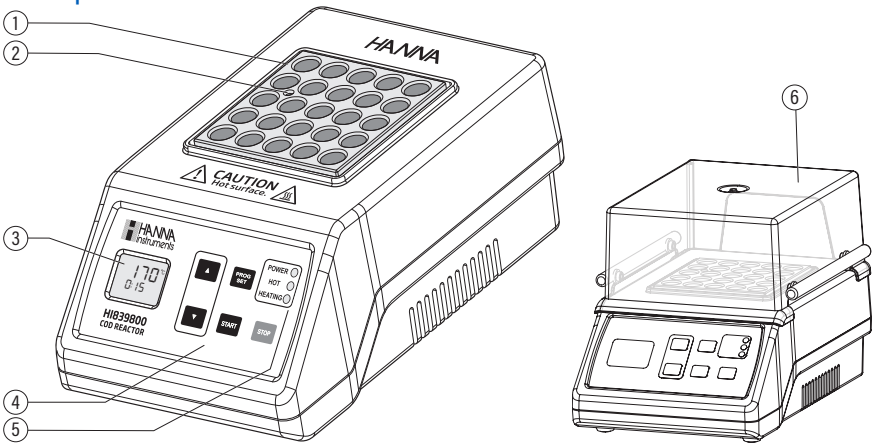
4. SPECIFICATIONS

Temperature range *	30.0 to 170.0 °C (86 to 338 °F)
Accuracy	±2 °C
Temperature stability	±0.5 °C
Capacity	25 vials; Ø 16 mm × 100 mm (Ø 0.63" × 3.94") Reference temperature probe well
Warm-up time	10 to 15 minutes, depending on selected temperature
Digestion time	1 to 180 minutes
Environment	5 to 50 °C (41 to 122 °F)
Power supply (fuse protected)	115 Vac (HI839800-01) 230 Vac (HI839800-02)
Dimensions	190×300×95 mm (7.5×11.8×3.7")
Weight	Approximately 4.8 kg (10.6 lb.)

* Reactor displays outside temperature range of 20 – 30 °C (68 – 86 °F) and 170 – 180 °C (338 – 356 °F).
Values below 20 °C (68 °F) and above 180 °C (356 °F) are not displayed.

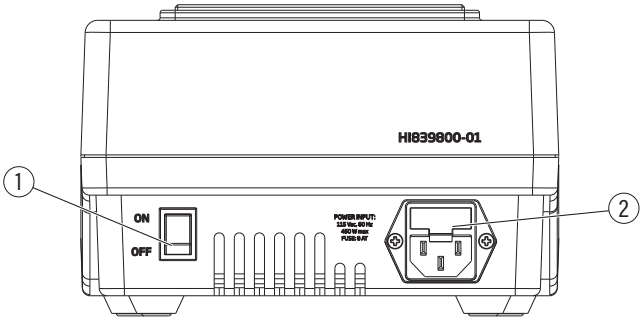
5. FUNCTIONAL DESCRIPTION

Front & Top View



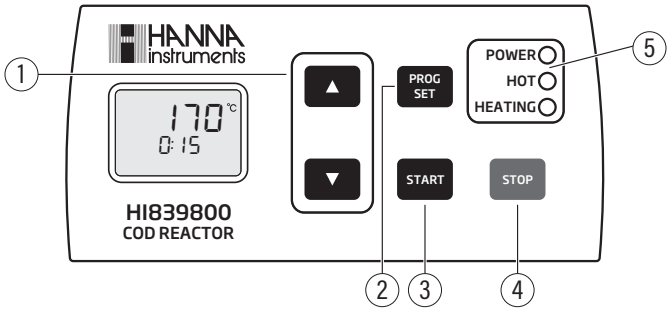
1	Reactor block	Up to 25 vial capacity
2	Reference temperature probe well	Holds reference temperature probe
3	LCD display	Displays temperature, timer, and status messages
4	Keypad	Select program, configure program profile, start/stop heating
5	Reactor block status light	Green (power on) Red (hot surface) Yellow (heating in progress)
6	Laboratory safety shield	Highly recommended to use during vial digestion procedure to maintain a safe working environment

Rear View



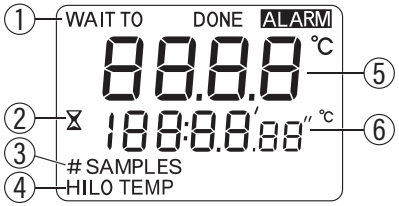
1	ON/OFF switch	Press to turn the reactor on (off)
2	AC power socket with fuse holder	115 Vac (HI839800-01) 230 Vac (HI839800-02)

Keypad



1	▲ ▼	• Program navigation (stored and custom) • Program configuration (temperature and time)	
2	PROG SET	• Long press to enter edit mode (custom programs) • Short press to save value	
3	START	• Start program • Start digestion	
4	STOP	• Stop digestion • Exit edit mode	
5	BLOCK STATUS LIGHTS	POWER (green)	reactor is turned on
		HOT (red)	reactor block temperature above 50 °C (122 °F)
		HEATING (yellow)	continuously on, heating in progress displayed blinking, block maintains a stable temperature

LCD Display



1	WAIT TO SAMPLES DONE ALARM	Status tags
2	⧗	Stability indicator
3	#	Program editing mode
4	HI / LO TEMP	Temperature above (HI) below (LO) configured temperature
5	First LCD line	Measured temperature
6	Second LCD line	Set temperature or reaction time

6. GENERAL OPERATIONS

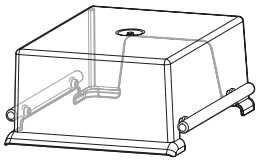
Guidelines & Safety Precautions

- Do not place the reactor near a heat source. Avoid the presence of flammable liquids near the operating reactor.
- Do not cover the ventilation slits on the side.
- Disconnect from power if an accidental spill occurs.
- Handling chemical samples, standards, and reagents can be dangerous. Review the Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.
- Reactor block heats up a few degrees higher than selected (configured) temperature as it accounts for localized heat transfer to vials.
- Reactor block temperature drops as vials are inserted into the reactor. Allow time for block temperature to reach required digestion temperature.

6.1. INSTALLING THE LABORATORY SAFETY SHIELD

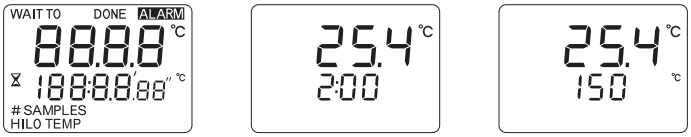
HI839800 is supplied with a laboratory safety shield with weighted handles that maintains proper safety position throughout digestion procedure.

Use of safety shield is strongly recommended to maintain a safe working environment.



6.2. STARTUP

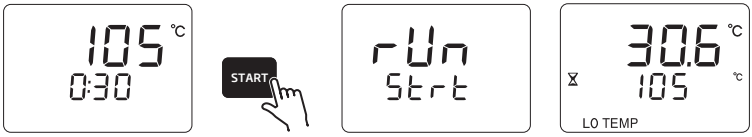
1. Place the reactor on a level and stable surface.
2. Connect to power. Check back of the instrument for correct voltage and frequency.
3. Switch the instrument on. POWER LED turns on.
   All LCD segments are briefly displayed followed by initialization screen. First LCD line displays block temperature and second LCD line displays the current reaction time and program temperature, alternately.



6.3. SELECT DIGESTION PROGRAM FROM STORED TEMPERATURE PROGRAMS

105 °C (221 °F), 150 °C (302 °F), 170 °C (338 °F) temperature programs are delivered with the reactor.

1. Use the arrow keys to navigate and select program.
2. With program selected, press START and the reactor block starts to warm up.



6.4. CONFIGURE PROGRAM PROFILE (CUSTOM PROGRAMS)

To add to the three stored programs, three custom programs can be configured and saved with the HI839800. Once the maximum limit of **six** (custom and stored) has been reached users need to select from custom programs and configure a new custom program.
To configure a stored program and create a custom program:

1. Use the ▲ ▼ keys to select from stored programs.
2. Press PROG SET to enter temperature edit mode.

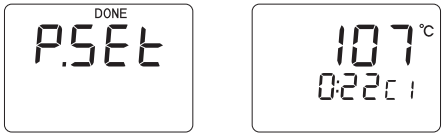
   Note: *Release the PROG SET key when TEMP is displayed (bottom of the screen) to allow editing mode.*
3. Use the ▲ ▼ keys to configure temperature value (displayed linking).

4. Press PROG SET to confirm.

Note: *Long pressing PROG SET skips temperature editing and enters instrument in timer value editing mode.*

5. Timer value starts blinking.
   Use the ▲ ▼ keys to adjust value.

6. Press PROG SET to confirm value.
   "DONE" status tag and "P.SEt" message is displayed followed by configured values.
   Custom programs are identified as C1, C2, or C3.



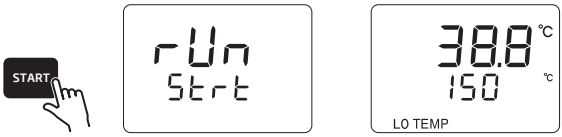
Notes: *Press the* STOP *key during editing to exit program configuration.*

Delete custom programs

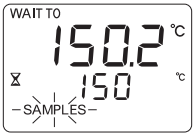
With the instrument off, keep the ▲ ▼ keys pressed and switch the instrument on. This automatically deletes all previously configured custom programs. "PrOG rESEt" message confirms reset.

6.5. DIGESTION PROCEDURE

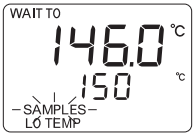
1. Press the START key. The **HEATING** LED lights up (yellow).
   "rUn Strt" message is displayed followed by the reactor block's current temperature and stored/configured program temperature.



- When the reactor block temperature exceeds 50 °C, the **HOT** LED (red) starts blinking.
- During warm up (10 to 15 minutes), the **HEATING** LED stays on (yellow) for as long as the block temperature is within 10 °C of target temperature.
- An acoustic signal (3 short beeps) alerts users that the block temperature has reached configured (selected) temperature profile and the reactor is ready for vials to be inserted.
  "WAIT TO SAMPLES" ("SAMPLES" blinking) is displayed.

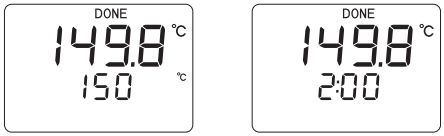


2. Insert the vials into the reactor. Block temperature may decrease.



3. Press the START key to start timed digestion. An acoustic signal (1 short beep) alerts users that operation is in progress. The block reactor heats up to configured temperature.
Countdown timer is automatically started.

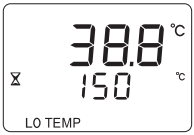
The end of the digestion time is signalled by an acoustic signal (5 short beeps) and "DONE" message is displayed. The heating is turned off and the block begins to cool off.



Note: *To end digestion before the timer countdown finishes, press the* STOP *key.*

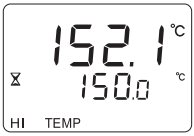
7. WARNINGS & ERRORS

The instrument displays warning messages when erroneous conditions appear and when values are outside the expected range. The information below provides an explanation of the errors and warnings, and recommended action to be taken.



"LO TEMP" is displayed during warm-up process when the reactor block temperature is lower than set program temperature profile.

- Wait for warm-up to finish.



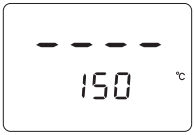
"HI TEMP" is displayed if the reactor block temperature is above the set program temperature profile.

- Wait for the reactor block to cool down.

ALARM tag and "HEAt FAILEd" message are displayed if the reactor block fails to heat up 5 minutes after pressing the START key. A long acoustic signal alerts users of the issue.

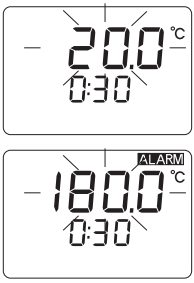
- Contact Hanna Instruments® technical support.

"PrOG FULL" is displayed when attempting to configure a fourth custom program.
- Reconfigure an existing *custom* program.



Broken temperature probe (sensor).
- Contact Hanna Instruments technical support.

HOT LED is displayed blinking when the reactor block temperature exceeds 50 °C. Do not touch the heating block.



Temperature is under/over range.
- Wait for warm-up to finish or wait for the reactor block to cool down.
- ALARM tag and an accoustic signal indicates the over range condition.

8. MAINTENANCE

Cleaning

1. Switch off the reactor and disconnect from power. Allow the reactor block to cool off.
2. Remove vials and wipe the instrument with a soft, damp cloth.
   Water should not reach inside the reactor block.

Replacing a spent fuse

Replace only with fuse of the specified type and current ratings.

1. Switch the reactor off and disconnect from power.
2. Turn the fuse holder counterclockwise until it disengages.
3. Retain the cap which holds the fuse, and replace the fuse in the cap with a new, appropriately rated fuse i.e. use "8 AT" for HI839800-01 and "5 AT" for HI839800-02 model.
4. Replace the fuse holder and rotate it clockwise.

9. HANNA INSTRUMENTS METHODS THAT REQUIRE DIGESTION

COD METHODS – HI801, HI83399, HI83314, HI97106

Parameter	Method	Reagent set (vial identification)	Range	Accuracy	Temperature/ Digestion time
COD LR EPA	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters	HI93754A-25 (COD A, red label)	0 to 150 mg/L (as O_2)	±5 mg/L or ±4 % of reading (whichever is greater)	150 °C / 120 minutes 170 °C / 15 minutes
COD LR Mercury Free	HI83314, HI83399, HI97106 Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters HI801 Dichromate Mercury Free	HI93754D-25 (COD D, red label)			
COD LR ISO	HI83314, HI83399, HI97106 Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters HI801 Dichromate ISO	HI93754F-25 (COD F, red label)			
COD MR EPA	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters	HI93754B-25 (COD B, white label)	0 to 1500 mg/L (as O_2)	HI83314 HI83399 HI97106 ±15 mg/L or ±4 % of reading (whichever is greater) HI801 ±15 mg/L or ±3 % of reading (whichever is greater)	
COD MR Mercury Free	HI83314, HI83399, HI97106 Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters HI801 Dichromate Mercury Free	HI93754E-25 (COD E, white label)			
COD MR ISO	HI83314, HI83399, HI97106 Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters HI801 Dichromate ISO	HI93754G-25 (COD G, white label)	0 to 1000 mg/L (as O_2)		
COD HR EPA	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters	HI93754C-25 (COD C, green label)	0 to 15000 mg/L (as O_2)	±150 mg/L or ±2 % of reading (whichever is greater)	
COD UHR	Adaptation of the US EPA 410.4 Approved Method for the COD Determination on Surface Waters and Wastewaters	HI93754J-25 (COD J, blue label)	0.0 to 60.0 g/L (as O_2)	±0.5 g/L ±3 % of reading	

OTHER METHODS – HI801, HI83399, HI83314

Parameter	Method	Reagent set (vial identification)	Range	Accuracy	Temperature / Digestion time
Chromium, (VI)/Total	Adaptation of the Standard Methods of the Examination of Water and Wastewater, 22nd Edition, 3500-Cr, Diphenylcarbazide Method	HI96781-25 (Cr, red label)	0 to 1000 µg/L (as Cr)	± 10 µg/L ± 3 % of reading	**105 °C / 60 minutes**
Iron, Total	Adaptation of Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 3500-Fe B, Phenanthroline Method	HI96778-25 (IRON, red label)	0.00 to 7.00 mg/L (as Fe)	±0.20 mg/L or ± 3 % of reading (whichever is greater)	**150 °C / 30 minutes**
Nitrogen, Total LR	Chromotropic Acid Method	HI93767A-50 (N LR, green label)	0.0 to 25.0 mg/L (as N)	±1.0 mg/L or ±5 % of reading (whichever is greater)	**105 °C / 30 minutes**
Nitrogen, Total HR	Chromotropic Acid Method	HI93767B-50 (N HR, red label)	0 to 150 mg/L (as N)	±3 mg/L or ±4 % of reading (whichever is greater)	
Phosphorus, Acid Hydrolyzable	Adaptation of the EPA Method 365.2 and Standard Methods for the Examination of Water and Wastewater, 20th Edition, 4500-P E, Ascorbic Acid Method	HI93758B-50 (P AH, white label)	0.00 to 1.60 mg/L (as P)	±0.05 mg/L or ±5 % of reading (whichever is greater)	**150 °C / 30 minutes**
Phosphorus, Total LR	Adaptation of the EPA Method 365.2 & Standard Methods for the Examination of Water and Wastewater, 20th Edition, 4500-P E, Ascorbic Acid Method	HI93758C-50 (P TLR, red label)	HI83314 HI83399 0.00 to 1.15 mg/L (as P) HI801 0.00 to 1.60 mg/L (as P)	HI83314 HI83399 ±0.05 mg/L or ±6 % of reading (whichever is greater) HI801 ±0.05 mg/L or ±5 % of reading (whichever is greater)	
Phosphorus, Total HR	Adaptation of Standard Methods for the Examination of Water and Wastewater, 20th Edition, 4500-P C, Vanadomolybdophosphoric Acid Method	HI93763B-50 (P THR, green label)	0.0 to 32.6 mg/L (as P)	±0.5 mg/L or ±5 % of reading (whichever is greater)	

HI83746 METHOD

Parameter	Method	Reagent	Range	Accuracy	Temperature / Digestion time
Reducing Sugars for Wine Analysis	Fehling Method	HI83746-20	0.00 to 50.00 g/L	±0.50 g/L ±5 % of reading	105 °C / 7 min.

10. ADDITIONAL EQUIPMENT & ACCESSORIES

Ordering Information	Product Description
HI740216	Test tube cooling rack
HI740217	Laboratory bench safety shield
HI801	iris® Spectrophotometer
HI83224	COD meter and multiparameter photometer
HI83314	Multiparameter photometer with COD for wastewater
HI83399	Photometer with COD for water & wastewater
HI83746	Photometer for the determination of concentration of reducing sugars
HI97106	COD portable photometer
HI83746-20	Reducing sugar analysis reagents set
HI93703-59	Charcoal for decoloration of red wine
HI93754X-25*	COD reagent vial sets of different ranges
HI93758B-50	Phosphorus, Acid Hydrolyzable reagent set
HI93758C-50	Phosphorus, Total LR reagent set
HI93763B-50	Phosphorus, Total HR reagent set
HI93767A-50	Nitrogen, Total LR reagent set
HI93767B-50	Nitrogen, Total HR reagent set
HI96778-25	Iron, Total reagent set
HI96781-25	Chromium, (VI)/Total reagent set

* Go to www.hannainst.com for reagent vial sets ordering codes.

CERTIFICATION

All Hanna® instruments conform to the **CE European Directives** and **UK Standards.**

Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste. Instead, hand it over to the appropriate collection point for the recycling of electrical and electronic equipment, which will conserve natural resources.

Disposal of waste batteries. This product contains batteries, do not dispose of them with other household waste. Hand them over to the appropriate collection point for recycling.

Ensuring proper product and battery disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, or the place of purchase.

RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meter's performance. For your and the meter's safety do not use or store the meter in hazardous environments.

WARRANTY

The HI839800 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering, or lack of prescribed maintenance is not covered. If service is required, contact your local Hanna Instruments® office. If under warranty, report the model number, date of purchase, serial number (engraved on the bottom of the meter), and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the meter is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any meter, make sure it is properly packed for complete protection.