QRAE+ Service Training

RAE SYSTEMS

PROTECTION THROUGH DETECTION

Training Agenda

- ***Repairs Allowed***
- ***Turning unit on in Diagnostic Mode***
- ***Diagnostic Mode Navigation***
- ***Inside the QRAE+***
- ***Pump Rebuild***
- ***Calibration***
- ***Configuration and Personal Settings***

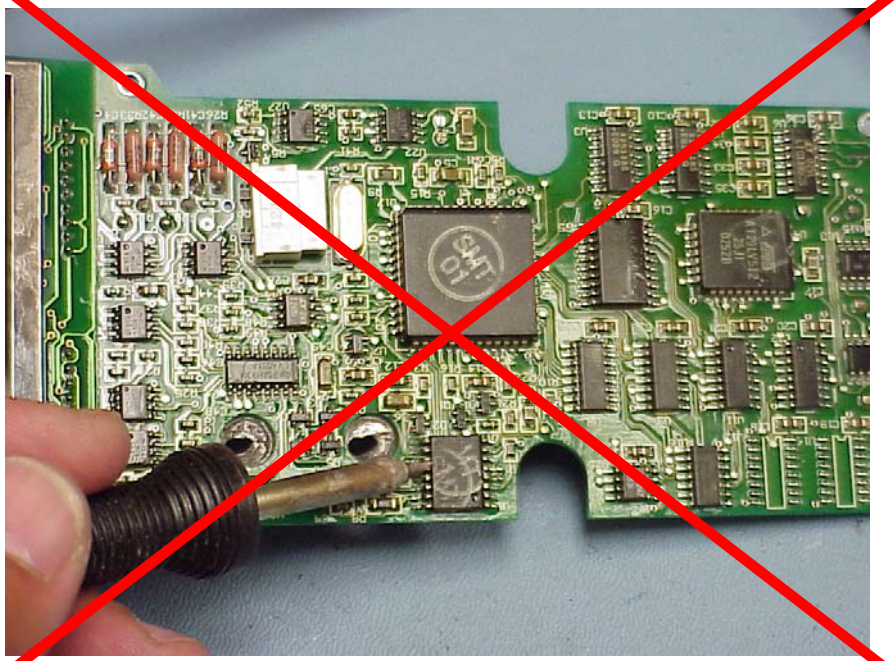
Repairs allowed

- Part Replacements: Sensors, Batteries, Pump, Housing, Membrane Panel, Tubing, Filters
- Pump rebuild
- PCB replacement through Service Department with serial number of unit
- Cleaning and Calibration

  *Always be careful of Electric Static Discharge when working on units. Please use ESD pads on workbench or wear ESD straps on shoes

Repairs Not Allowed

- Soldering and PCB replacement is not allowed on any of our units! This can compromise Intrinsic Safety of unit and is not allowed under ATEX approval rating



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QRAE+: Navigation

Turning unit on in Diagnostic Mode

- With QRAE+ turned off, hold down “Y/+” key
- While still holding “Y/+” key, depress and hold the “MODE” key.
- Hold both keys down for 2 seconds, after which the QRAE+ will beep, release both keys
- The fourth warm-up screen will say “Diagnostic Mode,” if you push the “Y” key now, the warm-up will speed up.
- Wait for the QRAE+ to go through the normal warm-up

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Diagnostics: Raw Sensor Outputs

150-200		150-200
2150-2190 ***1900-2200***	RAW	1000-1350

- Main display in Diagnostic Mode (The Italics reading for LEL is the %/VOL sensor).
- In fresh air the RAW reading should be within the indicated ranges (SO2, NO, NO2, HCN, & Cl2 read between 120-210, NH3 will be between 200-900 & PH3 reads between 120-400)

Diagnostics: Raw Sensor Outputs

350-800		300-500
2400-3400 ***2400-2900***	RAW	100-200

- With span gases applied, the RAW reading should be within the indicated ranges
- Span gases: 50 ppm CO, 100 ppm Isobutylene, 10 ppm H_2S, 50% LEL Methane (2.5% CH4)/*20 VOL% CH_4*, 99.9% N2 (0% Oxygen)

Diagnostics : Sensor Testing

- Determine Delta by subtracting span value from fresh air value. Delta should be checked against numbers found in TN-123
  - Values can be out of range in RAW and SPAN as long as the Delta is within limits and the sensor calibrates
  - Any value that is extremely out of range, continue the tests below
- Check PCB where sensor plugs to board
  - Make sure shorting pin is removed
  - Sensor is completely plugged in
  - No corrosion is found

TN-123

Sensor	Gas	RAW Range	SPAN Range	New Delta	Old Delta
LEL/TC	50%LEL Methane	2150-2190	2400-3400	>300	>100
O2	99% Nitrogen	1000-1350	100-200	>800	>300
CO	50 ppm CO	150-200	350-800	>200	>100
H2S	10 ppm H2S	150-200	300-500	>150	>50
SO2	5 ppm SO2	120-210	400-1000	>300	>100
NO	25 ppm NO	120-210	350-550	>200	>50
NO2	5 ppm NO2	120-210	350-550	>120	>50
HCN	5 ppm HCN	120-210	300-600	>150	>50
NH3	50 ppm NH3	200-900	1500-3700	>800	>200
PH3	5 ppm PH3	120-400	1200-3500	>1000	>200
Cl2	10 ppm Cl2	120-210	340-900	>240	>100

Diagnostics: Sensor Names

CO		H2S
LEL	RAW	OXY

- Displays names of sensors installed in QRAE+

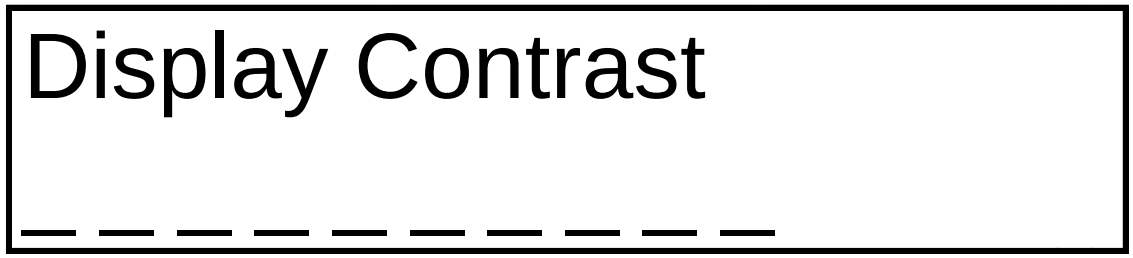
Diagnostics: Battery

BatV=215	Charge!
ChV=161	ChI= 81

- Battery voltage
- Charge input sampling
- Charging current

- Values are not useful for testing

Diagnostics: Display Contrast



- In cold weather the display may fade prematurely and in hot weather the display may “bleed”
- Use “Y/+” key to increase contrast and “N/-” key to decrease contrast.
- Press the “MODE” key to accept

Diagnostics: Buzzer Frequency

Buzzer freq.=
4208Hz <+/->

- The buzzer frequency can be adjusted for the best output sound volume

Diagnostics: LEL Sensor

%LEL Sensor
RAW=2172

- Type of LEL sensor
  - %LEL
  - %/VOL
- RAW value of LEL sensor

Diagnostics: Clock/Bat./Temp.

Aug 13, ‘01	12:00
Bat = 3.9V	78°F

- Date
- Time of day
- Battery voltage
- Temperature in Fahrenheit or Centigrade

Diagnostic Mode: Warranty Expiration

O2 expires 02/02

LEL expires 02/02

- Warranty expiration date is calculated based on date of manufacture
  - Warranty Replacement sensors have the same warranty period as original sensor
    - When calling in a WR we need the following: Serial number of the unit and/or the sensor, warranty expiration date, RAW Air and RAW Span
- A sensor with expired Warranty is still good to use if it calibrates and tests correctly

Diagnostics: Adjust Pump Stall Threshold

Pump stall speed
Y – low N – high

- Allows you to go to Low or High pump speed where you can make adjustments to the pump stall threshold
- If the gas inlet is blocked but the pump does not shut down, the raw count of the pump stall threshold is set too high
- If the pump shuts down too easily with a slight blockage to the gas inlet, the raw count of the pump stall threshold may be set too low

Diagnostics: Adjust Pump Stall Threshold

Pump = 27 / 25
Stall = 42 +/-

- Block pump inlet for less than 3 seconds*: if pump reading increases, set stall to the average of the pump current and the blocked reading
- Block pump inlet for less than 3 seconds*: if the pump current reading does not increase by more than 5 counts: check tubing, clean pump and/or rebuild or replace pump

*If held longer, the pump can be damaged

Pump Issues

- Pump does not stall
  - Adjust Pump Stall Threshold
  - Check tubing for leaks
  - Rebuild/clean pump
- Sensors respond slowly to gas or Unit calibrates OK but doesn't see gas sample
  - Check tubing for leaks
  - Rebuild/clean pump
  - Tests sensors with gas applied directly to the sensor

Diagnostics: Serial Number

SN 402422

- Serial Number of QRAE+ is displayed

Diagnostics: Battery Duration Test

Battery duration time: 14hr 19mn

- Shows the run time of the last time the QRAE+ turned itself off due to a low battery
- This is useful for battery life testing
  - Charge battery completely
  - Turn unit on and allow to run until battery dies
  - Charge unit again and turn on in Diagnostic mode

Communicate with PC Display

Communicate
with PC?

- If “Y/+” key is pushed then QRAE+ will display “Monitor will Pause. OK?”
- If “Y/+” key is pushed again the QRAE+ will display “ready...” after 60 seconds, unit will no longer communicate with PC
- Tap “MODE” key to return to Main Display

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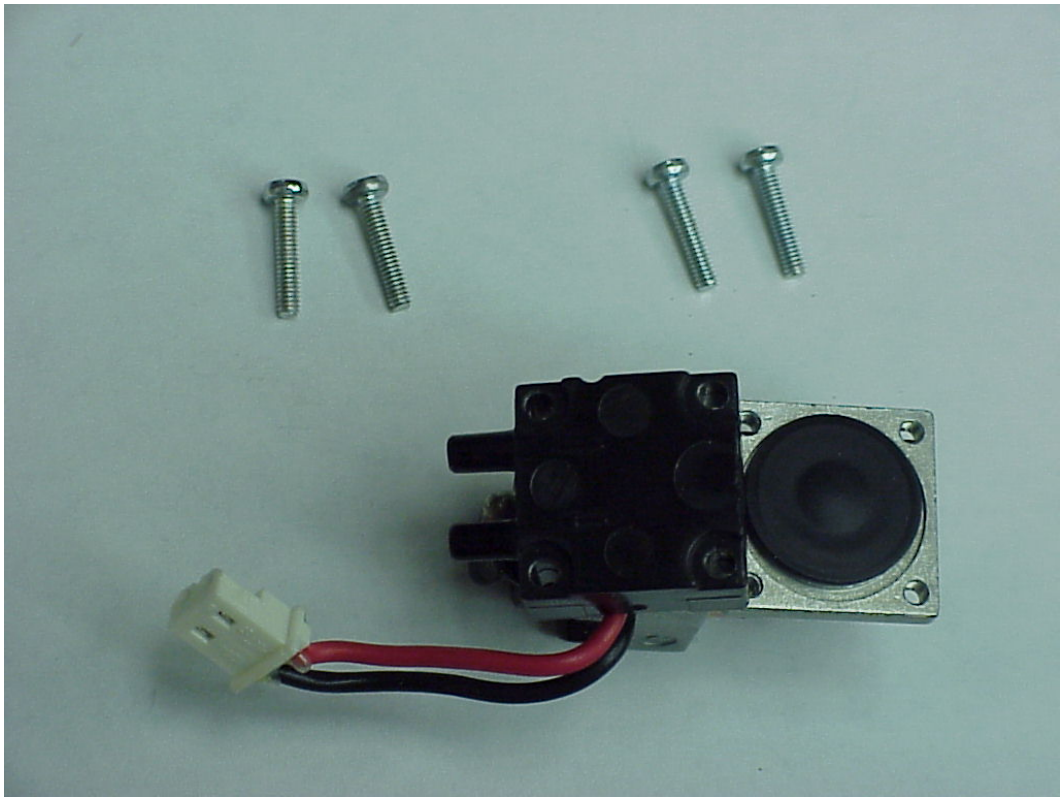
Why Rebuild Pump?

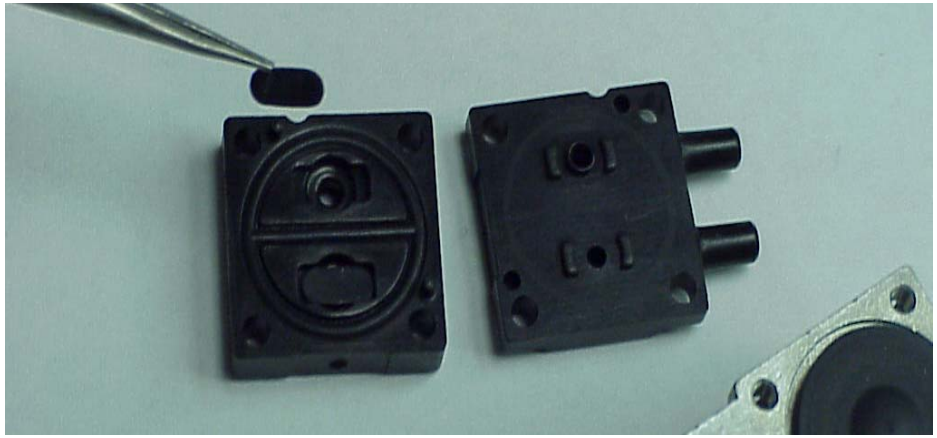
- New Pump Assembly costs $295.00
  - 015-3043-000
- Pump rebuild kit costs $40.00
  - (081-0007-000)
- Most pump problems can be resolved with a cleaned or rebuilt pump

Clean/Rebuild Pump

- Remove pump from unit
- Separate head from chassis by removing 4 screws



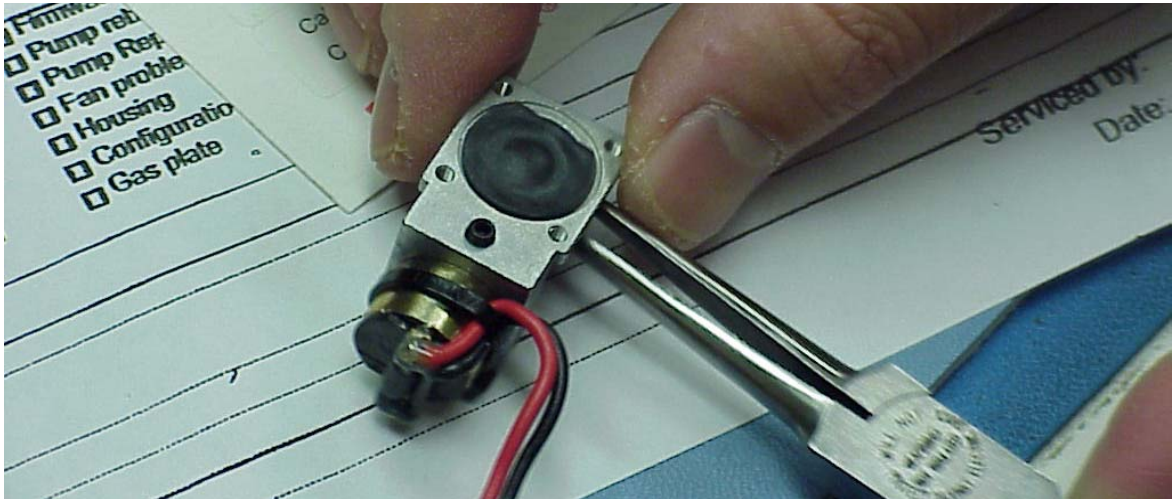
Clean/Rebuild Pump



- Blow out gas inlets and valve seats
- Wipe rubber valves and rubber pump diaphragm clean
- Remove old diaphragm and flapper valves – replace with new ones (only old pumps will take these parts, all newer pumps have different heads and require cleaning only)

Clean/Rebuild Pump

- Hold Piston steady with pliers, tweezers or screwdriver.
- Wiggle Main Diaphragm onto the piston arm. Make sure diaphragm is centered
- Clean diaphragm w/Methyl Alcohol



Installation of Pump

- Place black valve body on top of metal/black chassis with gas inlets pointing over motor
- Replace 4 screws and tighten snugly
- For all units, test before closing unit (silver units: Connect tubing)
    - Turn unit on in Diagnostic Mode
    - Perform Stall test
    - Verify in Normal Operations that pump will stall
- If unit passes testing, finish installation and close instrument

Training Agenda

- *Repairs Allowed*
- *Turning unit on in Diagnostic Mode*
- *Diagnostic Mode Navigation*
- *Inside the QRAE+*
- *Pump Rebuild*
- *Membrane Panel Replacement*
- ***Calibration***
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PROTECTION THROUGH DETECTION

QRAE+: Calibration

- After performing service it is always important to calibrate the QRAE+

QRAE+: Navigation

You can calibrate the unit from Diagnostic Mode as you would in normal operations

Getting into Programming from Diagnostic Mode

- *Hold "MODE" and "N/-" keys for 5 sec. to get in Programming Mode – The unit will normally ask for a password, default password is 0000*
- If QRAE+ asks a question "?"
  - Answer "Y" or "N"
- To Accept or Escape
  - Use "MODE" Key
- ***Hold "MODE" and "Y/+" keys for 5 sec. to get in Regular operations***

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Using ProRAE Suite

- Updating Firmware
- Config All
  - Always run “Config All” with upgrade of firmware
  - Only way to reset a lost password
- Editing Configuration Files
- Upgrade to Datalogging

Questions?