PICU

TRANSCUTANEOUS MONITORING

tCOM+ Competency Checklist

This form is a self-assessment tool. The practitioner should be able to discuss the rationale for each of the actions and demonstrate competency in the practical applications of these skills as applicable.

Full Name:	**Date:**
Department:	
Medical Device: tCOM+ with V-Sign Sensor	

Competencies Required:

- Bedside Experts ☐
- Correlation Experts "Superusers" ☐
- Maintenance and Troubleshooting Experts ☐

Bedside Experts

Manage the training and implementation of how to apply the sensor and rings, appropriate site time and sensor temperature, sensor calibration, and how to manage the sensor during disconnection for kangaroo care and bed changes.

		Achieved
1.	Identify the clinical indications for using transcutaneous monitoring	☐
2.	Demonstrate or describe how to turn on the monitor	☐
3.	Describe the function of the following sub-menus:	☐
4.	Name the icons relevant to patient monitoring that can be seen in the Status Bar	☐
5.	Name the approved measurement sites for patient monitoring	☐
6.	Define the recommended site time and sensor temperature for PCO_2 monitoring	☐
7.	Describe what a good quality sensor looks like and what problems to look out for	☐
8.	Explain how to verify that the monitor is ready to use for patient monitoring	☐
9.	Demonstrate or describe the process for sensor application	☐
10.	Explain how to determine if the transcutaneous value is stabilized after application	☐
11.	Explain or demonstrate how to use Smart Cal-Mem and how long the sensor can be disconnected before returning to patient monitoring	☐
12.	Explain how you can easily troubleshoot a high or low $tcPCO_2$ value at the bedside	☐
13.	Explain the steps to clean and calibrate the sensor after site time elapses	☐

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Correlation Experts "Superusers"

In addition to the Bedside Expert Competencies, these users understand the relationship between perfusion and the correlation of $tcPCO_2$ readings to blood gases. They know what can impact the reading and how to troubleshoot values that are not correlating.

	Achieved
14. Explain some of the main factors that can affect the $tcPCO_2$ reading	☐
15. When should you record the $tcPCO_2$ value when comparing the value to an ABG?	☐
16. What can cause $tcPCO_2$ values that are higher than the ABG? What can you do to resolve the issue?	☐
17. What can cause $tcPCO_2$ values that are lower than the ABG? What can you do to resolve the issue?	☐
18. What are the 5 S's you can check for if you are troubleshooting poor correlation between the transcutaneous CO_2 value and blood gas?	☐
19. Explain the following low-priority alarms or issues and how to fix them:	
Connect sensor	☐
Sensor off patient	☐
Values not stabilizing after sensor application	☐
20. Name the common error messages and where to locate troubleshooting resources	☐
21. Explain how the monitor and sensor are to be stored between uses	☐
22. Explain how to add an event during patient monitoring and list scenarios where it may be helpful to set an event	☐
23. Explain the concept of RHP and how it can help when troubleshooting poor correlation or a sudden change in $tcPCO_2$	☐

Maintenance and Troubleshooting Experts

These users are responsible for keeping the Sentec Digital Monitoring System running smoothly, including cleaning procedures, membrane changes, and troubleshooting simple error messages.

	Achieved
24. Explain or demonstrate how to change the gas bottle	☐
25. Explain how often the sensor membrane should be changed and where on the monitor the membrane lifetime is shown.	☐
26. Demonstrate or describe how to re-membrane the sensor	☐
27. Explain how to troubleshoot these error messages and where to find troubleshooting resources:	
Sensor Problem 11	☐
Sensor Problem 12	☐
Gas Leak in Docking Station	☐
28. Identify the recommended cleaning product to use after every patient monitoring session	☐
29. Describe when and how to complete a sensitivity test	☐
30. Describe when and how to complete a clean and soak of the Sentec sensor	☐

Practitioner Signature _____ **Date** _____

Trainer Signature _____ **Date** _____

PICU

TRANSCUTANEOUS MONITORING

tCOM+ Competency Checklist Key

Bedside Experts

1. Clinical Indications

Transcutaneous CO_2 monitoring is indicated for any patient on respiratory support requiring ventilation monitoring in the PICU.

2. Power On

The ON/OFF button is located on the left side of the monitor beneath the gas cannister.

3. Main Menu

Tap the arrow on the left side of the display to enter the Main Menu.

Alarm Settings: Set and adjust parameter alarm limits

Measurement Settings: Adjust site time and temperature, settings for enabled parameters, and start monitoring.

Trend Settings: Adjust trend ranges and time scale for enabled parameters.

Events: Log and view events, e.g. ventilator changes, blood gases, medication administration, etc

Tutorials: Access step-by-step guides for application, maintenance, and troubleshooting procedures.

Sensor Maintenance: Calibrate the sensor, confirm a membrane change and view the membrane change interval, and perform a sensitivity test.

Profile Selection: Select a preconfigured measurement profile.

4. Status Bar

Favorites: Build a library of frequently used workflows by saving them to the Favorites menu.

Monitoring Time: indicates the remaining measurement time. Yellow indicates that calibration is recommended; yellow with a cyan background indicates that monitoring time has elapsed.

Heating Mode: indicates whether specific heating settings are on or off and displays sensor temperature.

Patient Type: indicates if the monitor is in Adult or Neonatal Mode.

Sensor Maintenance: opens a menu showing calibration status, membrane change interval, and when the last sensitivity test was performed. Yellow indicates the membrane change is due in < 3 days; yellow with a cyan background indicates that a membrane change is mandatory.

Alarm Bar: displays Status Message about alarms or monitor/sensor information.

Alarm: indicates the status of the auditory alarm signals (ON, Paused, OFF).

Gas Level: indicates the remaining content of the gas bottle. Tapping on the icon will prompt a pop-up message indicating the fill state in %.

Screenshot: takes a screenshot of the current tCOM+ screen. Screenshots can be viewed and exported by going to the **Main Menu** > **Review & Export** > **Screenshots**.

Battery: indicates the battery status and remaining battery capacity in %. The icon is highlighted yellow when the battery is low and and yellow with a cyan background when critically low..

5. Measurement Sites

Neonatal (PCO2 only): forehead, upper chest, abdomen and flanks, upper thighs, and back.

Pediatric:

PCO_2/SpO_2/Pulse Rate (PR): forehead, cheek, earlobe, upper arm, shoulder blade

PCO_2 only: beneath the clavicle, lower arm.

6. Site Time and Temperature

Neonatal patients (younger than term birth + 12 months): 41°C for up to 8 hours.

Pediatric (older than term birth + 12 months): 42°C for 8 hours (up to 12 hours maximum).

Note: Extending the site time from the recommended 8 hours to 12 hours may increase the risk of erythema or other thermal injuries. Pay special attention to patients with fragile or sensitive skin at the sensor site.

7. Sensor Inspection

A good quality sensor has a smooth membrane surface, functioning red LED, and an intact sensor cable. Do not use the sensor if the membrane has a dried-out appearance, air bubbles under the membrane, or if the center ring appears silver instead of brown.

8. Ready for Use

Before initiating patient monitoring, ensure the current tCOM+ settings and profile are appropriate for the patient, the selected measurement site, skin condition and perfusion at the selected measurement site, and specific clinical setting. At a minimum, check the patient type, enabled parameters, sensor temperature, site time, and alarm specific settings.

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9. Sensor Application

1. Verify the system displays "Ready for Use."

2. Clean patient skin site and allow to dry. Apply the Multi-Site Attachment Ring to the measurement site, gently pressing around the ring to ensure good adhesion to the skin. Verify that the skin under the adhesive is not wrinkled.

3. Remove the sensor from the Docking Station and close the door.

4. Apply 1-2 small drops of Contact Gel to the skin in the center of the ring or onto the sensor surface.

5. Holding the sensor by the neck, (1) insert the sensor nose-first into the ring and (2) press gently downward on the neck until it clicks into place. Rotate the sensor within the ring to distribute the Contact Gel.

6. Tape the sensor cable in place if desired and ensure that there will be no tension on the cable during monitoring. Do not tape over the sensor.

10. Stabilization

Transcutaneous readings typically stabilize within 2-10 minutes after sensor application. Once stabilized, the TC reading will turn from grey to green (default color).

11. Smart Cal-Mem™

The sensor can be disconnected from the sensor adapter cable for up to 30 minutes without needing to remove the sensor from the skin and recalibrate. To use Smart Cal-Mem, simply unplug the sensor, perform the necessary tasks (e.g. change the bed linen, get patient out of bed for Kangaroo care, reposition patient) and reconnect within 30 minutes. The $tcPCO_2$ values will begin to stabilize once the sensor is reconnected.

12. Troubleshooting $tcPCO_2$ Values

If the $tcPCO_2$ reading is higher than expected, check the measurement site. External pressure on the sensor from the patient's position, bedding, dressings, medical devices, or diapers can decrease blood flow at the measurement site and cause higher $tcPCO_2$ values.

If the $tcPCO_2$ reading is lower than expected, check the sensor application. Air between the sensor and the skin caused by a loose sensor attachment, loose application ring, or lack of Contact Gel can cause lower $tcPCO_2$ values.

13. Sensor Cleaning and Calibration

Once the site time elapses, remove the sensor, and inspect the skin. Gently clean the sensor face and outer rim with 70% isopropanol. Do not scrub or apply force when cleaning the sensor surface. Hang the sensor in the Docking Station door with the red light facing out and close the door. The monitor will check the sensor and – if necessary – start the sensor calibration (message 'Calibration in progress'). The message 'Ready for use' will display once calibration is complete.

Correlation Experts "Superusers"

14. Limitations

The $tcPCO_2$ reading can be affected by the following: hypo-perfused skin beneath the sensor site due to shock, hypothermia, or use of vasoactive drugs; inadequate measurement site; Improper sensor application resulting in an inadequate, not hermetically sealed contact between the sensor surface and the patient's skin (ex. no Contact Gel).

15. ABG Comparison

Blood sampling should be performed in steady state conditions. The $PaCO_2/PaO_2$ value obtained from ABG analysis should be compared to the $tcPCO_2/tcPO_2$ reading at the time of blood sampling.

16. $tcPCO_2$ values > ABG

- Low perfusion at the measurement site.
- Sensor applied to a measurement site that is inadequate or not recommended for PCO_2 monitoring.
- The sensor has not had enough time to stabilize before patient monitoring. After turning on the monitor or changing the sensor membrane, it is recommended to store the sensor in the Docking Station with the monitor on for the duration indicated by the message "Recommended sensor stabilization time" on the Ready for Use screen.
- Technical issues, such as expired calibration gas, undetected gas leak in the Docking Station, or an aging sensor.

17. $tcPCO_2$ values < ABG

- Air between the sensor and the skin, either from a loose attachment or too little/no Contact Gel. Verify that the sensor is securely attached and ensure that air gaps are eliminated between the skin and the sensor. If needed, reapply the sensor (on same or an alternate site).
- Sensor applied to a measurement site that is inadequate or not recommended for PCO_2 monitoring. Apply the sensor to a recommended measurement site with an appropriate Sensor Attachment Accessory.
- The sensor has not had enough time to stabilize before patient monitoring. After turning on the monitor or changing the sensor membrane, it is recommended to store the sensor in the Docking Station with the monitor on for the duration indicated by the message "Recommended sensor stabilization time" on the Ready for Use screen.
- Technical issues, such an aging sensor.

18. The 5 S's

Sample: Be sure to record TCM value at the time the blood sample is collected. In patients with shunts, ensure that the sensor and the sampling site are both pre- or post-ductal. Pay attention to proper blood gas collection procedures.

Sensor: Ensure the sensor is set to the recommended temperature. Consider the age and condition of the sensor membrane.

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Site: Check for external pressure on the sensor and the perfusion at the measurement site. If necessary, move the sensor to a more central site.

Seal: Always use 1-2 drops of Contact Gel during application and rotate the sensor within the ring to ensure good attachment.

Status: Certain patient conditions, such as edema, vasoactive drug therapy, sepsis, and shunting can affect the local perfusion and impact the $tcPCO_2$ measurement.

19. Low-priority Alarms

Connect Sensor: Check to make sure the sensor adapter cable is plugged into the back of the monitor and the adapter cable is connected to the sensor. To identify the defective part, exchange the sensor adapter cable or the Sentec Sensor and try again.

Sensor off Patient: Check the sensor application. The sensor may be loosely attached to the patient, Contact Gel was not used during sensor application, or the monitoring site has poor perfusion.

Values not stabilizing: The sensor may be loosely attached to the patient with air between the sensor and the skin or no contact liquid. Verify that the sensor is securely attached and reapply the sensor on the same site if needed. Ensure that the sensor is applied to a recommended monitoring site.

20. Common Error Messages

Three common error messages are Sensor Problem 11 (SP11), Sensor Problem 12 (SP12), and Gas Leak in Docking Station (DS). Troubleshooting tutorials can be found by opening the **Main Menu** and choosing **Tutorials**. Troubleshooting videos can be found on our Product Support Page.

21. Monitor and Sensor Storage

The sensor should always be stored in the Docking Station of the monitor. During frequent use, the monitor should remain switched on and connected to power.

22. Adding an Event

During patient monitoring, events may be added to track and assess the impact of various interventions, such as a blood gas, ventilation setting change, intubation, extubation, medication administration, or manipulation.

Press and hold at the time of the event to open the **Events** menu or open the **Main Menu** and choose **Events**. Adjust the date and time as needed, then choose from the preconfigured events or create a custom event. Press **Confirm** to set the event, which will be visually represented by an orange diamond at the top of the trend graph.

23. Relative Heating Power (RHP)

Heating Power is the electrical power needed to heat a sensor applied to the skin and maintain the constant temperature. As blood flow (and its associated cooling effect) increases, the sensor requires more power to maintain the selected sensor temperature and, therefore, the heating power increases. Conversely, as blood flow decreases, the sensor heating power decreases.

Once the sensor is stabilized on the skin, an RHP-reference is set. Fluctuations of the heating power, visualized in the RHP trend line, may indicate changes in local skin blood flow. For example, if the $tcPCO_2$ rises while the heating power decreases, this may indicate that something has affected the perfusion at the measurement site and the clinician should check the site for any external pressure applied to the sensor.

Maintenance & Troubleshooting Experts

24. Changing the Gas Bottle

Remove the old gas bottle by turning it counterclockwise. Remove the cap from the new gas bottle. Insert the gas bottle into the slot and turn it clockwise, approximately 4.5 turns. Do not overtighten the gas bottle. After a few seconds, the **Gas Level** icon will update to show the status of the new bottle.

25. Membrane Change Interval

The membrane of a Sentec transcutaneous sensor must be changed every 28 days —sooner if the membrane is damaged or missing, has a loose fit, or if there is trapped air or dry electrolyte beneath the membrane. The Sensor Maintenance menu, which can be accessed by tapping the Sensor Maintenance icon in the Status Bar, indicates the remaining time until the next membrane change.

When the Sensor Maintenance icon turns yellow, the membrane change is due in 3 days or less. When the icon turns yellow with a cyan background, the membrane change is required.

26. Changing the Sensor Membrane

Keep the Membrane Changer horizontal while executing the four pressing and turning steps.

1. Remove the old sensor membrane: Press down slowly but firmly with palm of hand and hold for 3 seconds. Release the top. Turn the top portion one click clockwise to the next step. Keep the Membrane Changer in the horizontal position, do not pick it up.

2. Clean the old electrolyte off the sensor surface: As in step 1, press the Membrane Changer slowly but firmly, release the top and turn clockwise to the next step.

3. Apply new electrolyte on the sensor surface: Press the Membrane Changer slowly but firmly for 3 seconds, release the top and turn clockwise to the next step.

4. Place a new membrane on the sensor: Press the Membrane Changer top down slowly but firmly for 3 seconds, re-lease the top and turn clockwise to the √ symbol. Press one last time or lift the sensor and remove it from the Membrane Changer. Check the condition of the sensor membrane and the integrity of the sensor.

To confirm the membrane change and reset the membrane change interval, enter the **Sensor Maintenance** menu, and select **Membrane Changed**. This will initiate an automatic calibration.

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Note: View illustrated instructions for the membrane change by opening the **Main Menu** and choosing **Tutorials**.

27. Troubleshooting Common Error Messages

Sensor Problem 11: Check the sensor's center ring. If the ring is brown and intact (not white or silver), remove the membrane and perform a clean and soak. After gently drying the sensor, apply a new membrane. Confirm the membrane change on the monitor and allow the sensor to calibrate. If the SP11 Error persists, contact qualified service personnel.

Sensor Problem 12: Check the sensor's center ring. If the ring is brown and intact (not white or silver), remove the membrane and perform a clean and soak. After gently drying the sensor, apply a new membrane. Place the sensor in the Docking Station and confirm the Membrane Change in the **Sensor Maintenance** menu. A Sensitivity Test will start automatically after confirming the membrane change for sensors with an SP12 error. The sensor must pass the Sensitivity Test to clear the SP12 Error. If the SP12 Error persists, contact qualified service personnel.

Docking Station Leak: Verify that the sensor is clean and properly placed into the holder at the inside of the Docking Station (DS) door. If the Gas Leak continues after calibration, check the gasket of the DS. Clean the DS gasket with 70% isopropanol. If the gasket is missing or defective, replace the gasket and calibrate the sensor. If the Gas Leak persists, contact qualified service personnel.

Note: View illustrated troubleshooting instructions by opening the **Main Menu** and choosing **Tutorials**.

28. Sensor Cleaning

The sensor face, housing, and cable should be cleaned after each monitoring session with 70% isopropanol or other approved cleaning agent. The sensor should always be stored in the Docking Station. The monitor should be cleaned weekly with a wipe soaked with 70% isopropanol. Only use the approved cleaning agents to clean and disinfect the monitor and sensor. For a full overview of the recommended low- and high-level cleaning agents, refer to HBQ-122 Cleaning and Disinfection Agents.

29. Sensitivity Test

The sensitivity test should be completed monthly. To perform a sensitivity test:

1. Insert the sensor into the Docking Station.

2. Press the **Sensor Maintenance** icon and select **Sensitivity Test**.

3. Follow the on-screen prompts which will instruct the user to open the Docking Station door for two minutes. Once the door is closed, the monitor will automatically perform a leak test, sensor calibration, and a sensitivity test.

If the 'Sensitivity Test' passed, the Status Message 'Ready for use' appears.

Note: View illustrated instructions for the Sensitivity Test by opening the **Main Menu** and choosing **Tutorials**.

30. Clean and Soak

The clean and soak should be completed quarterly (every three months).

1. Remove the sensor membrane using the membrane remover on the bottom of the Membrane Changer.

2. Immerse the sensor into clean, room temperature water for 3 minutes.

3. After 3 minutes, gently rinse the sensor with clean water.

4. Lightly dab the sensor dry using lint-free gauze. Do not touch the ring and pH-glass in the center of the sensor. Do not rub the sensor surface.

5. Inspect the ring around the pH glass to ensure it is brown and intact.

6. Inspect the sensor to ensure that the grooves on the sensor circumference are clean and intact.

7. Once the visual inspections are passed, re-membrane the sensor using the Membrane Changer.

Note: View illustrated instructions for the Clean and Soak by opening the **Main Menu** and choosing **Tutorials**.