

4. Softly rinse the sensor with clean water.
5. Dab the sensor dry using a clean lint-free towel. Pay attention not to touch the ring and the pH-glass in the center of the sensor surface. Do not rub the sensor surface!
6. Inspect the ring around the pH-glass for damage and brownish color. Note that the same criteria apply for the OxiVenT™ Sensor (3.1).
If the ring around the pH-glass is broken, parts of it are missing, the brown color is lost, or the ring has a metallic luster, then replace the sensor with a new Sentec TC Sensor (3.1, 3.12).
7. Inspect the sensor to ensure that the grooves on the sensor circumference are clean and intact. If the grooves on the sensor circumference are damaged, replace the sensor with a new Sentec TC Sensor. Do not use the sensor if there is any visible damage to/trapped air underneath the membrane or if the red LED does not light when the sensor is connected to the tCOM+.
8. OxiVenT™ Sensor only: Verify that the white oxygen sensing spot (i.e., off-centered, white, circular spot) is present and intact.
9. If the visual inspections (steps 6 to 8) passed, re-membrane the sensor using the Membrane Changer (see 3.12).

4.2 Troubleshooting during Patient Monitoring

A complete troubleshooting overview is provided in the 'Service Manual for the tCOM+' (HB-013767), available on the Sentec website (sentec.com/ifu). It describes problems, possible causes and the recommended corrective action(s) the operator, qualified or Sentec authorized service personnel may perform to resolve the problem. Furthermore, the website offers guidance on frequently asked questions relating to troubleshooting.

4.3 Alerts and Error Messages

4.3.1 Monitor and Sensor problems/faults

The tCOM+ distinguishes between sensor faults (SFxx), monitor faults (MFxx), sensor problems (SPxx) and monitor problems (MPxx). "xx" indicates the respective fault or problem number. Sensor faults relate to situations where – as a safety precaution – the tCOM+ switches the sensor off. In the event of a sensor or monitor fault, the operator must restart the tCOM+ to reset the fault condition. Sensor problems, in contrast, relate to situations where the tCOM+ switches off the sensor temporarily and/or resumes operation (in certain cases with reduced functionality). Monitor problems relate to situations where the tCOM+ requires operator intervention prior to resuming operation.

Status Message	Status Code	TYPE	Description & possible Solution
Sensor Problem 10: Calibration Failed	SP10	Low priority alarm	The tCOM+ detects that the potential measured by the sensor's pH electrode at the end of the sensor calibration is outside a predefined range / low voltage potential is detected. This alarm ceases when removing the sensor from the Docking

Status Message	Status Code	TYPE	Description & possible Solution
			Station. Until successful termination of the next sensor calibration, PCO₂ values are marked as invalid, and the alarm is reactivated if the sensor is placed in the Docking Station. Note: This message is only generated if PCO₂ is enabled, and the sensor is in the Docking Station.
Sensor Problem 11: Calibration Failed	SP11	Low priority alarm	The tCOM+ detects that the sensor's PCO₂ readings are stable but too slow, as the calibration could not be terminated within 14 minutes. This alarm ceases when removing the sensor from the Docking Station. Until successful termination of the next sensor calibration (within ≤14 minutes), PCO₂ values are marked as invalid, and the alarm is reactivated if the sensor is placed in the Docking Station. Note: This message is only generated if PCO₂ is enabled, and the sensor is in the Docking Station.
Sensor Problem 12: Calibration Failed	SP12	Low priority alarm	The tCOM+ detects that the sensor's PCO₂ sensitivity is deteriorated, or an operator initiated 'PCO₂ sensitivity test' has failed. This alarm ceases when removing the sensor from the Docking Station. Until an operator initiated 'PCO₂ sensitivity test' has successfully been terminated, PCO₂ values are marked as invalid, and the alarm is reactivated if the sensor is in the DS. Note: This message is only generated if PCO₂ is enabled, and the sensor is in the Docking Station. Note: If 'SP12: Calibration Failed' reoccurs after successful termination of an operator initiated 'PCO₂ sensitivity test', it could be possible that the Docking Station is defective.
Sensor Problem 14: Calibration Failed	SP14	Low priority alarm	The tCOM+ detects that the sensor's PCO₂ readings are unstable and/or too slow as an 'Extended Calibration' could not be terminated within 14 minutes. This alarm ceases when removing the sensor from the Docking Station. Until successful termination of the next sensor calibration, PCO₂ values are marked as invalid, and the alarm is reactivated if the sensor is in the Docking Station. Note: This message is only generated if PCO₂ is enabled, and the sensor is in the Docking Station. Note: An 'Extended Calibration' is initiated if a regular sensor calibration could not be finished successfully within 14 minutes due to an unstable sensor. Note: Refer to the Status Messages 'Extended Calibration', 'PCO₂ slow' and 'SP11: Calibration Failed'.
Sensor Problem 15: Calibration Failed	SP15	Low priority alarm	The tCOM+ detects that the potential measured by the sensor's pH electrode at the end of the sensor calibration is outside a predefined range / high voltage potential is detected. This alarm ceases when removing the sensor from the Docking Station. Until successful termination of the next sensor calibration, PCO₂ values are marked as invalid, and the alarm is reactivated if the sensor is placed in the Docking Station. Note: This message is only generated if PCO₂ is enabled, and the sensor is in the Docking Station.
Sensor Problem 20: LED failure	SP20	Low priority alarm	The tCOM+ detects that the sensor's red LED is defective. SpO₂/PR are marked as invalid irrespective of sensor position.

Status Message	Status Code	TYPE	Description & possible Solution
			The sensor still can be used for PCO₂ (and PO₂) monitoring. PI is also available. Note: This message is only generated if SpO₂/PR is enabled, and a Sentec TC Sensor is in the Docking Station. Note: 'SP20: LED Failure' resets upon restarting of the tCOM+ or if the problem does not reoccur when inserting the sensor into the Docking Station.
Sensor Fault 21: Contact Service	SF21	Low Priority alarm	The tCOM+ detects that the sensor's IR LED is defective. The tCOM+ switches off the sensor. To reset 'SF21: Contact Service' and to restart the sensor, the tCOM+ must be switched off and restarted. Contact qualified service personnel or your local Sentec sales representative if restarting the tCOM+ does not reset the message. Note: A defective Docking Station may also trigger SF21.
Sensor fault 31	SF31	Low Priority Alarm	The tCOM+ detected repeatedly that the difference between the sensor's two redundant temperature measurements has been too large for 80 seconds. The tCOM+ switches the sensor off. To reset 'Sensor fault 31' and to restart the sensor, the tCOM+ must be switched off and restarted. Do not use the sensor if this message cannot be reset by restarting the tCOM+. Instead, contact qualified service personnel or your local Sentec representative.
Sensor fault 33	SF33	Low Priority Alarm	The tCOM+ has repeatedly not received temperature data from the sensor for 10 seconds. The tCOM+ switches the sensor off. To reset 'Sensor fault 33' and to restart the sensor, the tCOM+ must be switched off and restarted.
Sensor fault 35	SF35	Low Priority Alarm	The tCOM+ detects repeatedly that temperature readings are frozen for 80 seconds. The tCOM+ switches the sensor off. To reset 'Sensor fault 35' and to restart the sensor, the tCOM+ must be switched off and restarted. Do not use the sensor if this message cannot be reset by restarting the tCOM+. Instead, contact qualified service personnel or your local Sentec representative.
Sensor Problem 38: High sensor temperature	SP38	Low Priority Alarm	The message 'High Sensor Temperature', caused by condition 'r2' (refer to message 'High Sensor Temperature' in chapter 4.3.2) persists for 5 minutes. The tCOM+ switches the sensor off and restarts it after 60 seconds. Note: Also, refer to messages 'Sensor problem 42', 'Sensor fault 39', and 'Sensor fault 43'. Note: No power will be provided to the sensor port for 60 seconds.
Sensor Fault 39: High sensor temperature	SF39	Low Priority Alarm	The tCOM+ detects that the sensor temperature exceeds 'SET temperature + 0.6 °C' while the sensor did not detect condition 'r1' (refer to message 'High Sensor Temperature' in chapter 4.3.2). The tCOM+ switches the sensor off. To reset 'Sensor fault 39' and to restart the sensor, the tCOM+ must be switched off and restarted.

Status Mes- sage	Status Code	TYPE	Description & possible Solution
			Do not use the sensor if this message cannot be reset by re-starting the tCOM+. Instead, contact qualified service person- nel or your local Sentec representative. Note: Also, refer to messages 'Sensor problem 38', 'Sensor problem 42', and 'Sensor fault 43'.
Sensor Prob- lem 42: High sensor tem- perature	SP42	Low Prior- ity Alarm	The message 'High Sensor Temperature', caused by condition 'a2' (refer to message 'High Sensor Temperature' in chapter 4.3.2) persists for 5 minutes. The tCOM+ switches the sensor off and restarts it after 60 seconds. Note: Also refer to messages 'Sensor problem 38', 'Sensor fault 39', and 'Sensor fault 43' Note: No power will be provided to the sensor port for 60 sec- onds.
Sensor Fault 43: High sensor temperature	SF43	Low Prior- ity Alarm	The tCOM+ detects that the sensor temperature exceeds 45.0 °C while the sensor did not detect condition 'a1' (refer to message 'High Sensor Temperature' in chapter 4.3.2). The tCOM+ switches the sensor off. To reset 'Sensor fault 43' and to restart the sensor, the tCOM+ must be switched off and re- started. Do not use the sensor if this message cannot be reset by re- starting the tCOM+. Instead, contact qualified service person- nel or your local Sentec representative. Note: Also, refer to messages 'Sensor problem 38', 'Sensor problem 42', and 'Sensor fault 39'.
Sensor fault 51	SF51	Low Prior- ity Alarm	The SDM repeatedly detected an EEPROM CRC mismatch of the connected sensor and switched the connected sensor off. Do not use the sensor. Contact qualified service personnel or your local Sentec representative.
Sensor fault 53	SF53	Low Prior- ity Alarm	The tCOM+ repeatedly detected a stack overflow warning of the connected sensor and switched the connected sensor off. To reset 'Sensor fault 53' and to restart the sensor, the tCOM+ must be switched off and restarted. Do not use the sensor if this message cannot be reset by re- starting the tCOM+. Instead, contact qualified service person- nel or your local Sentec representative.
Sensor fault 61	SF61	Low Prior- ity Alarm	The tCOM+ detects that a connected sensor draws a current but will not communicate. The tCOM+ therefore interrupts all power to the sensor. Do not use this sensor. Contact qualified service personnel or your local Sentec representative.
Sensor prob- lem 70	SP70	Low Prior- ity Alarm	The tCOM+ detects that the LED of the connected OxiVenT™ Sensor's PO ₂ module is defective. PO ₂ is marked as invalid, ir- respective of sensor position. The sensor can still be used for monitoring of the other parameters. Note: This message is only generated if PO ₂ is enabled and the sensor is in the Docking Station.
Sensor prob- lem 71	SP71	Low Prior- ity Alarm	The tCOM+ detects that the photodiode of the connected OxiVenT™ Sensor's PO ₂ module is defective. PO ₂ is marked as invalid, irrespective of sensor position. The sensor can still be used for monitoring of the other parameters. Note: This message is only generated if PO ₂ is enabled and the sensor is in the Docking Station.

Status Message	Status Code	TYPE	Description & possible Solution
Sensor Problem 72: PO ₂ Calibration Failed	SP72	Low Priority Alarm	The tCOM+ detects that the sensor's PO₂ sensitivity is deteriorated, or an operator initiated 'PO₂ sensitivity test' has failed. This alarm resets when removing the sensor from the Docking Station. Until an operator initiated 'PO₂ sensitivity test' is successfully terminated, PO₂ values are marked as invalid, and the alarm is reactivated when the sensor is in the DS. Note: This message is only generated if PO₂ is enabled, and the sensor is in the Docking Station. Note: If 'Sensor problem 72' reoccurs after successful termination of an operator initiated 'PO₂ sensitivity test', it could be possible that the Docking Station is defective.
Sensor Problem 73: PO ₂ Calibration Failed	SP73	Low Priority Alarm	The tCOM+ detects a PO₂ module error for the connected OxiVenT™ Sensor. PO₂ is marked as invalid, irrespective of sensor position. The sensor can still be used for monitoring of the other parameters. Replace the sensor to continue monitoring PO₂. Note: This message is only generated if PO₂ is enabled, and the sensor is in the Docking Station.
Sensor Problem 74: PO ₂ Calibration Failed	SP74	Low priority alarm	The tCOM+ detects that the sensor's PO₂ readings are too slow or too unstable as the PO₂ calibration could not be terminated within 14 minutes. This alarm resets when removing the sensor from the Docking Station. Until successful termination of the next PO₂ calibration (within ≤14 minutes), PO₂ values are marked as invalid and the alarm is reactivated if the sensor is placed in the Docking Station. Note: This message is only generated if PO₂ is enabled and the sensor is in the Docking Station.
Monitor fault xx	MFxx	Low Priority Alarm	The monitor surveillance has detected monitor fault xx, where xx specifies the fault number. Note: Monitor faults xx (MFxx) relate to situations where – as a safety precaution – it is required to restart the tCOM+ to try to reset the fault condition. Do not use the tCOM+ if restarting does not reset the message. Instead, contact qualified service personnel or your local Sentec representative. Note: Prior to sending the tCOM+ to repair, it is possible to export trend data.
Monitor problem xx	MPxx	Low Priority Alarm or Information	The monitor surveillance has detected monitor problem xx, where xx specifies the problem number. Switch off and restart the monitor. Do not use the tCOM+ if the message still appears. Instead, contact qualified service personnel or your local Sentec representative. Note: Prior to sending the tCOM+ to repair, it is possible to export trend data.
Monitor Problem 42: Check Profile Settings	MP42	Low priority alarm	If the tCOM+ detects that profile data is inconsistent when powering up, it will shortly display the POST screen and then displays the following information text (only in English): <i>Some of the monitor's Parameter Settings were found to be inconsistent and therefore were reset to factory defaults. Verify the settings and adjust the parameters prior to use if necessary.</i> Once the user has accessed the menu, the tCOM+ starts full operation and the message 'Monitor Problem 42' resets.

Status Mes- sage	Status Code	TYPE	Description & possible Solution
			Note: 'Monitor Problem 42' may also be triggered when a new software version is installed that includes a different parameter setting structure.

Note: The color and pattern of display Status Bar and LED bar is identical for all alarms listed above.

4.3.2 Technical status messages and status codes

The following Table lists all Status Messages in alphabetical order along with the corresponding Status codes. Status Codes without a corresponding Status Messages are provided at the end of the table.

Status Mes- sage	Status Code	Type	Description & possible solution
Atm. P. unsta- ble	AU	Infor- mation	During an ongoing sensor calibration the tCOM+ detects that the atmospheric pressure is unstable and aborts the ongoing sensor calibration. As soon as the atmospheric pressure is restabilized, this alarm ceases and sensor calibration starts automatically. This message also ceases if the sensor is removed from the Docking Station. Note: This message only appears if PCO₂ is enabled and the sensor is in the Docking Station. Note: The 'Barometer Icon' is highlighted yellow if the atmospheric pressure is unstable.
Barometer fault	BF	Low Prior- ity Alarm	The tCOM+ detects a barometer fault (pressure readings fluctuating implausibly fast or pressure readings out of range). Sensor calibration will not be initiated or a calibration in progress will be aborted. The alarm ceases if the sensor is removed from the Docking Station. Note: This message only appears if PCO₂ is enabled and the sensor is in the Docking Station. Note: The 'Barometer Icon' is highlighted red in this case.
Barometer fault (tech- nical)	BFt	Low Prior- ity Alarm	The tCOM+ detects a technical barometer fault (chip readout failed). Sensor calibration will not be initiated or a calibration in progress will be aborted. To reset the fault condition, the operator must switch the tCOM+ off and restart it. If the fault reappears after restarting, please contact qualified service personnel. Note: This message only appears if PCO₂ is enabled, and the sensor is in the Docking Station. Note: The 'Barometer Icon' is not highlighted in this case.
Battery critical (not con- nected to AC power)	BC	Medium Priority Alarm	The remaining battery capacity is below a critical value and the monitor is not connected to AC power. If the tCOM+ is not reconnected to AC power, 5 or less minutes remain until the tCOM+ shuts down. Note: The 'Battery Icon' is highlighted red if the remaining battery capacity is critical.

Status Mes- sage	Status Code	Type	Description & possible solution
Battery critical (connected to AC power)	BCc	Infor- mation	The remaining battery capacity is below a critical value and the monitor is connected to AC power. If the tCOM+ is disconnected from AC power, 5 or less minutes will remain until the tCOM+ shuts down. Note: The 'Battery Icon' is highlighted red if the remaining battery capacity is critical.
Battery low	LB	Low Prior- ity Alarm	The remaining battery capacity is below 10% and the tCOM+ is not connected to AC power. Note: The 'Battery Icon' is highlighted yellow if the remaining battery capacity is below 10% irrespective of whether the tCOM+ is connected to AC power or not.
Calibration in progress	SC	Infor- mation	Sensor calibration in progress. Note: This message only appears if PCO ₂ is enabled, and the sensor is in the Docking Station. Note: If the 'Calibration Interval' has elapsed prior to (or during) the ongoing calibration, the 'Remaining Monitoring Time Icon' remains highlighted yellow until successful termination of the ongoing calibration.
Calibrate sen- sor	CSi	Low Prior- ity Alarm	An event triggering a so-called 'Initial Calibration' occurred and sensor calibration therefore is mandatory . Insert the sensor into the Docking Station. Calibration will start automatically. Note: This message only appears if PCO ₂ is enabled, and the sensor is outside the Docking Station. Note: After an event that triggers a so-called 'Initial Calibration', PCO ₂ and – if enabled – PO ₂ are marked as invalid. Note: Unless the 'Site Time' has expired, the 'Remaining Monitoring Time' icon is highlighted yellow if a calibration is requested. Note: If the Status Code 'CSi' is output while the sensor is in the Docking Station, the sensor is not (yet) calibrated.
Calibrate sen- sor	CSo	Low Prior- ity Alarm	This message may appear if the PO ₂ channel has not been in use for a prolonged time while the PCO ₂ channel was active. The PO ₂ channel therefore requires mandatory calibration. Insert the sensor into the Docking Station. Calibration will start automatically. Note: This message only appears if PO ₂ is enabled, and the sensor is outside the Docking Station. Note: PO ₂ is marked as invalid. Note: Unless the 'Site Time' has expired, the 'Remaining Monitoring Time' icon is highlighted yellow if a calibration is requested. Note: If the Status Code 'CSo' is output while the sensor is in the Docking Station, the sensor is not (yet) calibrated.
Change sensor membrane	RS	Low Prior- ity Alarm	Change of the sensor membrane is required. Change the sensor membrane. Note: This message only appears if PCO ₂ is enabled. Note: PCO ₂ is marked as invalid if a change of the sensor membrane is required.

Status Mes- sage	Status Code	Type	Description & possible solution
			Note: The alarm condition ceases if you confirm the mem- brane change on the monitor.
Check sensor application	CA	Low Prior- ity Alarm	This message is displayed if PCO₂ and/or PO₂ readings do not stabilize within 10 minutes after sensor application or after de- tection of a 'TC-Artifact'. The adequacy of the sensor applica- tion must be verified. Adjust the sensor application if neces- sary. This alarm ceases as soon PCO₂ and/or PO₂ readings sta- bilize. Note: This message only appears if PCO₂ or PO₂ is enabled, and the 'Sensor-On-Patient' is detected. Note: PCO₂ and/or PO₂ are marked as unstable in this situa- tion. Note: This message will also appear if the sensor temperature deviates by more than 2 °C from the Sensor Temperature for more than 10 minutes. Note: This message will also appear if the 'Enforced Sensor- On-Patient Mode' is active and PCO₂ is below 24mmHg cuta- neous after a stable reading was detected.
Connect sen- sor	CoS	Low Prior- ity Alarm	No sensor connected to the tCOM+, the cable of the con- nected sensor or of the adapter cable used to connect the sen- sor is defective, or the connected sensor is not compatible with the tCOM+. Note: Also see message 'Incompatible sensor'.
Docking Sta- tion fault	DFxx	Low Prior- ity Alarm	The monitor surveillance has detected a Docking Station fault. Note: This message only appears if PCO₂ is enabled, and the sensor is in the Docking Station. 'xx', the number of the specific Docking Station fault, is only indicated in the Status Code but not in the Status Message. Note: Sensor calibration will not be initiated or a calibration in progress will be aborted. As soon as the problem is resolved, this alarm ceases and a sensor calibration will start automati- cally. The alarm also ceases if the sensor is removed from the Docking Station.
Extended Cal- ibration	EC	Infor- mation	An extended sensor calibration is in progress after the regular sensor calibration was not successful within 14 minutes due to fluctuating PCO₂ readings during the calibration (this can be the case if the sensor was not used for a longer period). Note: This message is only displayed if PCO₂ is enabled, and the sensor is in the Docking Station. Note: After successful completion of an 'Extended Calibra- tion', the message 'Ready for use' is displayed. 'PCO₂ slow' is displayed if the duration of the 'Extended Calibration' lasted 14 minutes and 'SP14: Calibration Failed' if the 'Extended calibra- tion' could not be terminated successfully within 14 minutes.
Gas bottle empty	GE	Low Prior- ity Alarm	Indicates that the gas bottle is empty, or no gas bottle is in place. In the 'Gas Bottle Empty' status a calibration cannot be initiated. Note: This message only appears if PCO₂ is enabled, and the sensor is in the Docking Station. Note: The 'Gas Icon' is highlighted red if the gas bottle is empty and yellow if the remaining capacity is < 10%.

Status Mes- sage	Status Code	Type	Description & possible solution
Gas bottle loose, please tighten	BL	Low Prior- ity Alarm	The tCOM+ detects that the gas bottle is not inserted properly. This message can be cleared by pressing 'Confirm', which will trigger another check. Note: This check is performed under the following conditions: 1. Insertion of a gas bottle detected 2. At the beginning of a normal calibration. Please screw in the gas bottle by additional $\frac{1}{4}$ - $\frac{1}{2}$ turn to ensure that the gas bottle is inserted properly. If the problem persists, please use another gas bottle.
Docking Sta- tion Error: Cal- ibration Failed	GL	Low Prior- ity Alarm	The tCOM+ has detected a Docking Station gas leak. An 'Initial Calibration' is requested when the sensor is removed from the Docking Station and PCO₂/PO₂ values will be marked as invalid until successful termination of the next sensor calibration/mandatory leak test. Note: This message only appears if PCO₂ is enabled, and the sensor is in the Docking Station. Note: If a gas leak was detected, the next sensor calibration will be followed by a mandatory leak test (see message 'Leak test in progress').
Heating re- duced	HR	Low Prior- ity Alarm	As a safety precaution, the sensor temperature has been reduced by Site Protection as the sensor application duration has overrun the selected 'Site Time' by more than 10% or 30 minutes. To reactivate normal sensor heating, remove the sensor from the patient and confirm the message 'Sensor off patient' in the Status Bar or insert the sensor into the Docking Station. This will also reset the Site Timer. Note: The 'Temperature Icon' is highlighted blue if heating is reduced. Note: This message only appears if the sensor is on the patient. Note: PCO₂/PO₂ is marked as invalid if heating is reduced.
High ambient light	HA	Infor- mation	This message is displayed whenever the monitor's oximetry channel detects a high ambient light level independently from its severity or the impact on the SpO₂, PR, or PI values. Shield the sensor from ambient light if this message appears. This message ceases as soon as the ambient light level is within a predefined range. Note: This message only appears if SpO₂/PR are enabled and 'Sensor-On-Patient' is detected. Note: SpO₂, PR, and PI are marked as questionable when high ambient light levels are detected.
High ambient light	SA	Infor- mation / Low Prior- ity Alarm	This message is displayed whenever the monitor's PO₂ channel detects a high ambient light level independently from its severity or the impact on the PO₂ values. Shield the sensor from ambient light if this message appears. This message ceases as soon as the ambient light level is within a predefined range. Note: This message only appears if PO₂ is enabled and 'Sensor-On-Patient' is detected.

Status Mes- sage	Status Code	Type	Description & possible solution
			Note: PO ₂ is marked as questionable when high ambient light levels are detected. If the ambient light level is too high, PO ₂ is marked invalid accompanied by a low priority alarm.
Incompatible sensor	IS	Low Prior- ity Alarm	The connected sensor is not compatible with the tCOM+ or the Sentec Identification Code stored in its memory is not readable or corrupt. Note: To clear this message, a restart of the tCOM+ is required.
Close Docking Station door	IDs	Infor- mation	This message appears during an operator-initiated PCO ₂ and/or PO ₂ sensitivity test at an intermediate step, when the operator is requested to place the sensor into the DS again. The message is accompanied by a high pitched two beep signal tone. Insert the sensor into the Docking Station within 10 minutes to expose the sensor to the calibration gas (otherwise, the sensitivity test will be aborted).
Leak test in progress	LT	Infor- mation	A mandatory leak test is in progress to ensure that the leak, which was detected after the previous calibration, is successfully fixed. The SDMS will be 'Ready for use' only after successful termination of the ongoing leak test.
Monitoring time < 15 min	TL	Infor- mation	Indicates that within 15 minutes either the 'Site Time' will expire or – if PCO ₂ is enabled – sensor calibration is recommended (whichever will occur first).
PCO ₂ slow	PS	Infor- mation	This message is displayed if the duration of the last sensor calibration (normal or extended) was 14 minutes. When removing the sensor from the Docking Station, this message ceases. PCO ₂ values are marked as questionable until successful termination of the next sensor calibration within 14 minutes. Note: This message only appears if PCO ₂ is enabled, and the sensor is in the Docking Station. If the sensor is outside the Docking Station/during monitoring only the Status Code 'PS' is output. Note: The sensor may still be used for PCO ₂ monitoring but the operator must be aware that for a slow sensor, 'PCO ₂ stabilization' will take longer, the sensor's response to changes in patient's PaCO ₂ levels will be slower and the PCO ₂ alarm condition delay will be longer than for a fast sensor. Note: Refer to Status Message 'SP11: Calibration Failed' and 'SP14: Calibration Failed',
PCO ₂ stabiliz- ing	CE	Infor- mation	PCO ₂ readings are stabilizing after sensor application or occurrence of a 'PCO ₂ artifact'. This message ceases as soon PCO ₂ is (re)stabilized. Note: This message only appears if PCO ₂ is enabled, and 'Sensor-On-Patient' is detected. Note: PCO ₂ is marked as unstable during PCO ₂ stabilization. Note: This message will also appear if the actual sensor temperature deviates by more than 2 °C from the set Sensor Temperature. Note: If PCO ₂ readings do not stabilize within 10 minutes after sensor application or after detection of a 'PCO ₂ artifact', the low priority alarm 'Check sensor application' is triggered. Note: Ambient air (intermittently) penetrating between the sensor surface and the skin, typically resulting in fast PCO ₂

Status Mes- sage	Status Code	Type	Description & possible solution
			changes, is the most frequent cause for 'PCO ₂ Artifacts'. In order to reduce the occurrence of 'PCO ₂ Artifacts', a good, hermetically sealed contact between the sensor surface and the patient's skin is essential.
PCO ₂ /PO ₂ stabilizing	TS	Infor- mation	This message appears if both transcutaneous parameters are stabilizing after sensor application or after occurrence of a 'TC-Artifact'. Also, see messages 'PCO₂ stabilizing' and 'PO₂ stabilizing'. Note: PCO₂ and PO₂ are marked as unstable during stabilization. Note: This message only appears if PCO₂ and PO₂ are enabled and 'Sensor-On-Patient' is detected.
PO ₂ stabilizing	OE	Infor- mation	PO₂ readings are stabilizing after sensor application or occurrence of a 'PO₂ artifact'. This message ceases as soon PO₂ is (re)stabilized. Note: This message only appears if PO₂ is enabled and 'Sensor-On-Patient' is detected. Note: PO₂ is marked as unstable during PO₂ stabilization. Note: This message will also appear if the actual sensor temperature deviates by more than 2 °C from the set Sensor Temperature. Note: If PO₂ readings do not stabilize within 10 minutes after sensor application or after detection of a 'PO₂ artifact', the low priority alarm 'Check sensor application' is triggered. Note: Ambient air (intermittently) penetrating between the sensor surface and the skin, typically resulting in fast PO₂ changes, is the most frequent cause for 'PO₂ Artifacts'. In order to reduce the occurrence of 'PO₂ Artifacts', a good, hermetically sealed contact between the sensor surface and the patient's skin is essential.
Open Docking Station door	OD	Infor- mation	This message appears after activation of an operator-initiated PCO₂ and/or PO₂ sensitivity test. The message is accompanied by a high pitched two beep signal tone. Open the Docking Station within 1 minute to expose the sensor to ambient air (otherwise, the sensitivity test will be aborted). Note: This message only appears if PCO₂ is enabled, and the sensor is in the Docking Station.
Ready for use	RU	Infor- mation	The tCOM+ and the connected sensor are 'Ready for use'. Note: This message only appears if the connected sensor is not 'ON Patient'.
Sensitivity test	ST	Infor- mation	This message appears during an operator-initiated PCO₂ and/or PO₂ sensitivity test or after confirming a membrane change upon display of the message 'SP12: Calibration Failed'. At the beginning of the test, it is temporarily replaced by the message 'Open Docking Station door', accompanied by a high-pitched two-beep signal tone. It appears again when the DS door is opened. About 2 minutes later, the message 'Close Docking Station door', also accompanied by the same high-pitched two-beep signal tone appears. Once the sensor is placed into the DS, the Status Message 'Sensitivity test' is displayed again. At the end of the test and if the test finished successfully, the Status Message 'Ready for use' appears. 'SP12:

Status Mes- sage	Status Code	Type	Description & possible solution
			Calibration Failed' is displayed if the PCO ₂ sensitivity test failed and 'Sensor problem 72' appears if the PO ₂ sensitivity test failed.
Sensor calibra- tion recom- mended	CS	Infor- mation	The 'Calibration Interval' has elapsed and sensor calibration is recommended (but not yet mandatory). Insert the sensor into the Docking Station. Calibration will start automatically. Note: This message only appears if PCO₂ is enabled and the sensor is outside the Docking Station. Note: Calibration is recommended if the 'Calibration Interval' has elapsed and the sensor was removed from the Docking Station less than 12 hours ago (if 'Calibration Interval' ≤ 8 hours), less than 13 hours ago (if 'Calibration Interval' = 9 hours), or less than 16 hours ago (if 'Calibration Interval' = 12 hours). Note: PCO₂ is marked as questionable if a sensor calibration is recommended. Note: Unless the 'Site Time' has expired, the 'Remaining Monitoring Time Icon' is highlighted yellow if calibration is recommended. Note: If the Status Code 'CS' is output while the sensor is in the Docking Station, the sensor is not (yet) calibrated.
Sensor Life- time < yy days (also see mes- sage Sensor usage time < xx h)	LL	Infor- mation	The remaining 'Lifetime' in days or 'Usage Time' in hours (whichever is shorter) of the connected OxiVenT™ Sensor is indicated. Note: This message only appears if the connected OxiVenT™ Sensors' is stored in the Docking Station when its remaining 'Lifetime' is less than 30 days or its 'Usage Time' is less than 300 hours. Note: Countdown of 'Lifetime' and 'Usage time' starts from first ex-factory use of an OxiVenT™ Sensor. Note: The 'Usage time' is only used if PO₂ is enabled and a) while the sensor is outside the Docking Station, i.e., if the OxiVenT™ Sensor is used for PO₂ monitoring or b) during PO₂ calibration. Note: The remaining and used 'Lifetime' and 'Usage Time' are indicated on the second page of the menu 'System Information'. Note: If the sensor's 'Lifetime' has expired, the tCOM+ triggers the low priority alarm 'Replace sensor' when/as soon as the sensor is in the Docking Station. If the sensor's 'Usage Time' has expired, the OxiVenT™ Sensor functions as a V-Sign™ Sensor only (i.e., no PO₂ monitoring is possible anymore) when/as soon as the sensor is in the Docking Station (tCOM+ triggers 'Usage Time elapsed').
Sensor usage time < xx h	LL	Infor- mation	Refer to the description of the message 'Sensor Lifetime < yy days' above.
Usage Time elapsed	UE	Infor- mation	The sensor's 'Usage Time' has expired (OxiVenT™ Sensor only). The OxiVenT™ Sensor functions as a V-Sign™ Sensor only (i.e., no PO ₂ monitoring is possible anymore) when/as soon as the sensor is in the Docking Station.

Status Message	Status Code	Type	Description & possible solution
Replace sensor	LE	Low Priority Alarm	The 'Lifetime' of the connected OxiVenT™ Sensor has expired. Monitoring with this sensor is no longer possible. Replace the sensor. Note: This message applies only to OxiVenT™ Sensors. Note: To ensure that patient monitoring is not interrupted if the 'Lifetime' expires during monitoring, this low priority alarm condition is only triggered as soon as/when the sensor is in the Docking Station.
Sensor off patient	SO	Low Priority Alarm	The sensor was dislodged or intentionally removed from the patient. Note: Pressing 'Confirm' while this message is displayed will terminate the 'Sensor off patient' alarm condition, reset the Site Timer to the selected 'Site Time', and - if reduced by Site Protection - reactivate sensor heating. The measurement screen will remain active. Note: Inserting the sensor into the Docking Station will also terminate the 'Sensor off patient' alarm condition.
Site time elapsed	TE	Low Priority Alarm	Indicates that the 'Site Time' has expired. Note: The 'Remaining Monitoring Time Icon' is highlighted red if the 'Site Time' has expired. Note: To terminate the 'Site time elapsed' alarm, remove the sensor from the patient and confirm the message 'Sensor off patient' in the Status Bar or insert the Sentec TC Sensor into the Docking Station.
SpO ₂ low signal	LS	Information	This message is displayed whenever the tCOM+ detects a weak pulsatile signal independently from its severity or the impact on SpO₂, PR or PI values. This may be caused by low perfusion at the measurement site. Verify the sensor application and the appropriateness of the monitoring site if this message appears. Note: This message only appears if SpO₂/PR are enabled, and 'Sensor-On-Patient' is detected. Note: SpO₂, PR, and PI are marked as questionable during episodes with a weak pulsatile signal.
SpO ₂ signal quality	MA	Low Priority Alarm or Information	If the quality of the signals measured by the connected sensor's photodiode is temporarily degraded, SpO₂, PR, and PI are marked as questionable. If the quality of these signals continues to be degraded, the message 'SpO₂ Signal Quality' will display and SpO₂, PR and PI will be marked as invalid (i.e., values replaced by '---') within 15 seconds. Additionally, a low priority auditory alarm signal will sound within 30 seconds from the beginning of the degraded signal. Note: This message only appears if SpO₂/PR are enabled, and 'Sensor-On-Patient' is detected. Note: A degradation of the signals measured by the connected sensor's photodiode may be caused by patient motion, by certain environmental conditions and/or by low perfusion.
High Sensor Temperature	OT	Low Priority Alarm	If the sensor detects that the sensor temperature exceeds predefined limits (<u>relative limit (r1)</u>: 'Sensor Temperature' + 0.35 °C (VS-A/P/N, OV-A/P/N); <u>absolute limit (a1)</u>: 44.9 °C

Status Mes- sage	Status Code	Type	Description & possible solution
			(VS-A/P/N, OV-A/P/N), the sensor immediately switches off its power-consuming parts and triggers the message 'High Sensor Temperature' with a delay of 10 seconds and the 'Temperature Icon' is highlighted red. The sensor resumes normal operation if the sensor temperature remains within the predefined limits. If despite of this safety precaution the sensor temperature continues to increase and exceeds a second set of predefined limits (<u>relative limit (r2)</u>: 'Sensor Temperature' + 0.6 °C; <u>absolute limit (a2)</u>: 45.0 °C), the tCOM+ switches off the sensor after 5 seconds and restarts the sensor after another 15 seconds. Note: This message only appears when SpO₂/PR are enabled (compare with HT status code). Note: The sensor temperature is supervised and controlled primarily by the sensor and – for redundancy – by the tCOM+. Note: Failure to cover the sensor site with a heat shield if operated under an external heat source (e.g., a radiant warmer) may cause the sensor temperature to exceed the above-mentioned predefined limits, thereby triggering the alarm & safety functions. Too high ambient temperature at the sensor site (e.g., in an incubator) may also cause the display of this message. The difference between the 'Sensor Temperature' and the ambient temperature at the sensor site must be at least 4 °C for V-Sign™ Sensors 2 and OxiVenT™ Sensors. Note: Also refer to Status Messages 'Sensor problem 38', 'Sensor problem 42', 'Sensor fault 39', 'Sensor fault 43'.
Watch battery low	LW	Low Priority Alarm or Information	At power up, the tCOM+ detected that the watch battery is low and the date/time setting of the tCOM+ therefore may be wrong. After the POST screen, a low priority alarm is triggered and a yellow information text appears, instructing the operator to contact a Sentec authorized service technician to change the watch battery as soon as possible and that meanwhile the tCOM+ may be used, provided the monitor's date/time is set to the correct value. Note: As long as the date/time has not been set in the menu of the tCOM+, normal operation of the tCOM+ will not be activated. Once the operator has set the date/time, the low priority alarm ceases and the tCOM+ starts normal operation. The message is continuously displayed to remind the operator that the watch battery must be replaced as soon as possible. Note: Also, see message 'Set Date/Time'.
Set Date/Time	DT	Low Priority Alarm	At power up, the tCOM+ detected that the date/time setting of the tCOM+ is wrong (this is the case if the watch battery was low or removed while the tCOM+ was switched off). After the POST screen, a low priority alarm is triggered, and the sub-menu 'Date/Time' is activated. Note: As long as the date/time has not been set in the menu of the tCOM+, normal operation of the tCOM+ will not be activated. Once the date/time has been set, the alarm ceases and the tCOM+ starts normal operation. Note: Under normal circumstances, this message should only occur after replacement of the watch battery (see message 'Watch battery low').

Status Message	Status Code	Type	Description & possible solution
Remote monitoring interrupted	RL	Low Priority Alarm	While the tCOM+/patient was remotely monitored the connection between the tCOM+ and the Central Station interrupted. Note: The 'Remote monitoring interrupted' alarm condition automatically ceases as soon as the connection between the tCOM+ and the Central Station is restored or a connection with another Central Station is established. Pressing 'Confirm' while this message is displayed will also terminate this alarm condition. Note: If the 'Remote monitoring interrupted' alarm condition is triggered while the monitor's alarm system is in the AUDIO OFF state, the tCOM+ will terminate the AUDIO OFF state. Note: The 'Remote monitoring interrupted' alarm may be indicative of a system or equipment problem (network, tCOM+, or Central Station PC), causing interruption of the connection between the Central Station and the respective tCOM+.

4.3.3 Docking Station leak & Replacing the Docking Station Gasket

In the event of a Docking Station leak or a possible damage, replace the Docking Station Gasket.



1. Clean or disinfect hands. Open Docking Station. Remove the rubber ring (Gasket) as depicted. Alternatively, it is possible to use a pair of plastic tweezers.



2. Place a new Gasket onto the groove of the Docking Station, gently press around the circumference of the Gasket to push it into the groove, using thumb or finger. Note that the calibration chamber (light grey, in the center of the Docking Station) has a suspension mechanism and may therefore be pushed inwards without any risk to the monitor.



3. Make sure the Gasket sits tightly and evenly in the Docking Station groove and does not bulge outwards. Dispose of the used Gasket.

Note: Sentec recommends changing the gasket of the Docking Station annually.

4.4 Service

To perform a safety check and for service or repair, contact qualified service personnel or your local Sentec representative. Please note that repair and service procedures which require opening the cover of the tCOM+ must be performed by Sentec service personnel.

Furthermore, the Service Manual for the tCOM+ (HB-013767, available on [sentec.com/ifu](https://www.sentec.com/ifu)) includes guidance on maintenance and safety and functionality tests intended for qualified personnel, troubleshooting procedures for a) the operator and b) qualified personnel. It also describes repair procedures that do not require opening the tCOM+, intended for qualified personnel only.

4.5 Software Update

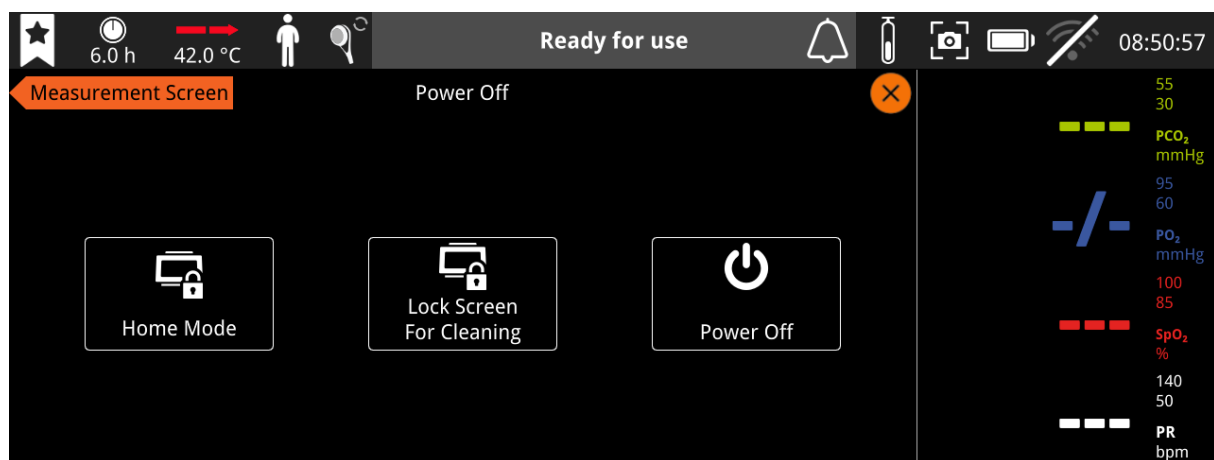
The software of the tCOM+ and its connected sensor can be upgraded via the DATA/SERVICE USB Port. Connect a USB type-C flash drive with the corresponding software to the port and choose 'Software Update' in the software update menu. This will automatically start the upgrade of the relevant components.

5 Further Applications of the tCOM+

5.1 Home use

The tCOM+ may be used to monitor patients on home ventilation or for other applications outside of hospitals and clinics.

To set up 'Home Mode', briefly press the 'ON/OFF Button' on the left side of the panel. This will bring up the screen depicted as follows. Tap on the 'Home Mode' icon and enter the 'Activation Pin' configured in the profile for home use. This will deactivate menu access to avoid patients changing monitor settings.



The instructed person from the homecare provider is responsible:

- For choosing an appropriate location for the tCOM+ and setting up the system at the patient's home/site.
- For switching on the monitor in time to allow sensor to stabilize with a sufficient available monitoring time.
- For checking the state of, and, if necessary, changing the gas bottle and sensor membrane.
- For configuring and selecting a patient specific tCOM+ Profile with the following settings (see 3.4):
 - Patient's individual measurement parameters
 - Audible alarms permanently deactivated
 - Display Sleep Mode set to 'Display OFF – Wake on Touch'
 - 'Home Mode' activation PIN code for deactivation of menu access to avoid patients changing monitor settings accidentally or on purpose.
- **Note:** Press the 'ON/OFF button to activate 'Home Mode' using the configured 'Home Mode' activation pin.
- For selecting appropriate measurement site(s), instructing the patient or caregiver how to use the system, how to perform basic navigation on the monitor and to access the on-screen tutorials on sensor application, and providing the "Directions for Lay Users", HB-012896, to the patient (see sentec.com/ifu – Home Care)
- To instruct the lay operator regarding the following:

- In the event of unforeseen incidents, error messages or unexplained changes in the performance of the device, patients shall contact their home care provider's instructed person.
- To use the tCOM+ only in-house and under the environmental conditions specified in the "Directions for Lay Users", HB-012896.
- To carefully route and fix cables to reduce the possibility of entanglement or strangulation.
- To make no changes to the device setup.
- For switching off and uninstalling the tCOM+ after successful termination of calibration
- For cleaning and disinfecting the tCOM+, the TC Sensors and the Sensor Adapter Cable between uses on different patients.
- For ensuring maintenance (4.1).

Note: The patient or lay operator cannot modify the tCOM+ configuration by using its menu when configured as above.

5.1.1 Qualifications / training requirements for home use

Some users of the monitor in the home environment will be caregivers trained on use of the monitor, but not medical professionals. Setting up the system and configuring the tCOM+ shall only be performed by an instructed person from a homecare provider. This instructed person must have received the appropriate training by a Sentec representative or Sentec authorized person.

6 Data Communication

6.1 Wired Communication

- **WARNING:** Only connect devices that comply with IEC 60601-1, IEC 62368-1 or IEC 60950-1 (SELV) to the tCOM+.
- **WARNING:** To avoid electrical shock, only connect approved devices to the tCOM+.

6.1.1 Serial Data Port (RS-232)

The serial data port (RS-232) of the tCOM+ is used to communicate with external data collection systems such as personal computers or multi-parameter bedside monitors. The interface allows remote monitoring and download of historical trend data. The serial data port (RS-232) is located on the rear panel of the tCOM+.

6.1.2 Network Port (LAN)

The Network Port of the tCOM+ is used to communicate with external computer-based data collection systems. The interface allows remote monitoring and download of historical trend data. The Network Port is located on the rear panel of the tCOM+. The Network Port is a standard RJ45 Ethernet connector.

6.1.3 Analog Output

The Analog Output of the tCOM+ provides up to four analog voltage outputs for PCO₂, PO₂, SpO₂, PR, and the Pleth Waveform. The Analog Output is located on the rear panel of the tCOM+.

6.1.4 DATA/SERVICE USB Port

The DATA/SERVICE USB Port of the tCOM+ is used for SW upgrades or data downloads through connecting a USB type-C flash drive. The DATA/SERVICE USB Port is located on the left side of the tCOM+.

- **WARNING:** To avoid wrong operation, only connect USB sticks to the DATA/SERVICE USB port. Do not connect any consumer products (e.g., charging units) to this port.

6.1.5 Universal Connectivity Port

The Universal Connectivity Port of the tCOM+ may be used to connect other devices in the future. It is currently not in use. The Universal Connectivity Port is located on the rear panel of the tCOM+. The Universal Connectivity Port is a standard USB type C port.

- **WARNING:** To avoid wrong operation, do not connect any consumer products (e.g., charging units) to this port.

6.1.6 Wireless Communication

- **WARNING:** This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

6.1.6.1 Wi-Fi

The tCOM+ provides a Wi-Fi interface to connect to external networks and is used to communicate with external computer-based data collection systems. Stored data and configuration parameters can be read out.

WiFi can be configured within a password-protected area upon tapping on the 'Interfaces' icon.

The Wi-Fi interface provides an 802.11 a/b/g/n/ac Wi-Fi with data rates up to 433.3 Mbps. The Wi-Fi interface can connect to 2.4 GHz and 5 GHz networks with standard encryption methods WEP/WPA/TKIP/WPA2 AES-CCMP.

Indoor use only.

U.S.A.: FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: Changes or modifications made to this equipment not expressly approved by Sentec may void the FCC authorization to operate this equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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FCC Radiation Exposure Statement

The product complies with the US mobile RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Canada: Innovation, Science and Economic Development Canada (ISED)

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Canada: Radiation Exposure Statement

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 centimeters between the radiator & your body.

Japan: Radio Law

This device is granted approval pursuant to the Japanese Radio Law. This device should not be modified (otherwise the granted designation number will become invalid).

European Union