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BioTector B7000 Online TOC TN TP Analyzer

Advanced Configuration

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Section 1 Advanced configuration

1.1 Safety information

Refer to the installation manual for general safety information, hazard descriptions and precautionary labels descriptions.

1.2 Set the average result

Set the number of reactions included in the average result for each parameter (e.g., TOC). The average result is the result that shows on the display and is saved to the reaction archive. Set when the result on the display is an average result or not an average result.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > RESULT INTEGRATION.
2. Select an option.

Option	Description
RESULT INTEGRATION	Sets the reaction point at which TOC result integration starts. TOC +BASE OXID (default)—The result integration starts with the base oxidation step and completes at the end of the TOC analysis. TOC —The result integration starts only during the TOC analysis.
TOC INTEGRATION	Sets the number of TOC reaction results included in the average result (default: 3). The average result is the result that shows on the display and is saved to the reaction archive.
TOC INT LIMITS	Sets when the TOC result that shows on the display is an average result and when the TOC result is not an average result. The first setting is the percent (%) band variation (default: 6%). The second setting is the absolute variation in mgC/L (default: 2.0). If the result is within the TOC INT LIMITS settings, the result that shows on the display is an average result. If the result is not within the TOC INT LIMITS settings, the result is not an average result. The result that shows on the display is the result for the last reaction.
TN INTEGRATION TP INTEGRATION	Sets the number of TN and TP reaction results included in the average TN result and TP result (default: 3). The average results are saved to the reaction archive and show on the display.
TN INT LIMITS TP INT LIMITS	Sets when the TN result and TP result that show on the display are an average result or not an average result. The first setting is the percent (%) band variation (default: 10%). The second setting is the absolute variation in mgN/L or mgP/L (defaults: TN = 0.5 and TP = 0.3). If the result is within the INTEGRATION LIMITS settings, the result that shows on the display is an average result. If the result is not within the INTEGRATION LIMITS settings, the result is not an average result. The result that shows on the display is the result for the last reaction.

1.3 Save 24-hour average results

Save 24-hour average of the reaction results for each sample stream to the reaction archive.

Note: The reaction results for manual samples (grab samples) are not included in the average.

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1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > AVERAGE PROGRAM.
2. Select an option.

Option	Description
LOG AVERAGE	Saves a 24-hour average of the reaction results for each sample stream to the reaction archive (default: NO).
AVERAGE UPDATE	Sets the time the 24-hour average is saved to the reaction archive (default: 00:00).

1.4 Configure the pressure test and flow test settings

Set the start time for the pressure test and flow test. Set the fault and warning limits for the pressure test and flow test.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > PRESSURE/FLOW TEST.
2. Select an option.

Option	Description
TIME	Sets the start time for the pressure test and flow test (default: 08:15). A pressure test identifies if there is a gas leak. A flow test identifies if there is a blockage in the gas exhaust or the sample out lines.
PRESSURE TEST FAULT	Sets the limit for a pressure test fault. A fault occurs (05_PRESSURE TEST FAIL) if the flow is more than the fault limit (default: 6.0 L/h). <i>Note: To disable the pressure test, select 0.0 L/h. When disabled, a 29_PRESSURE TEST OFF warning occurs. In addition, an "OFF" message shows on the display.</i>
PRESSURE TEST WARN	Sets the limit for a pressure test warning. A warning occurs (26_PRESSURE TEST WARN) if the flow is more than the warning limit (default: 4.0 L/h) but less than the fault limit. The warning limit is usually 30% less than the PRESSURE TEST FAULT setting. <i>Note: To disable the pressure test warning, select 0.0 L/h. When disabled, an "OFF" message shows on the display.</i>
PRESSURE CHCK FAULT	Sets the limit for a pressure check fault. The analyzer does a pressure check at the end of each reaction to identify if there is a gas leak. A fault occurs (06_PRESSURE CHCK FAIL) if the flow is more than the fault limit (default: 6.0 L/h) for the number of consecutive reactions selected in the PRESSURE CHCK COUNT setting. <i>Note: To disable the pressure check, select 0.0 L/h. When disabled, an "OFF" message shows on the display.</i>
PRESSURE CHCK COUNT	Sets the number of consecutive reactions before a pressure check fault occurs (default: 3).
FLOW WARNING	Sets the limit for a flow test warning. A warning occurs (22_FLOW WARNING – EX or 23_FLOW WARNING – SO) if the flow is less than the fault limit (default: 72.0 L/h).

1.5 Configure the zero calibration settings

Set the zero calibration settings (e.g., number of reactions done at each operation range) and the alarm limits for zero calibrations and zero checks. Show the history of changes to the zero adjust values.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > ZERO PROGRAM.
2. Select an option.

Option	Description
ZERO PROGRAM	<p>Sets the number of reactions done at each operation range (1, 2 and 3) during a zero calibration or zero check (Default: 6, 0, 0). The three settings are for operation range 1, range 2 and range 3.</p> <p>Note: <i>The analyzer does the zero calibration and zero check reactions only at the operation range(s) that are not set to 0. The analyzer calculates the TOC , TP and TN zero adjust values for the operation ranges that are set to 0.</i></p>
ZERO AVERAGE	<p>Sets the number of zero reactions included in the average value the analyzer uses to set the zero adjust values. The three settings are for operation range 1, range 2 and range 3 (e.g., 3, 0, 0).</p>
TN BAND TP BAND	<p>Sets the % (e.g., 200%) and the intensity counts (e.g., 100) for the zero tolerance values (maximum change level) for the TN and TP zero adjust values.</p> <p>At the end of the zero calibration and zero check, the analyzer uses the ZERO AVERAGE settings (e.g., 3, 2, 2) to calculate the average of the TN and TP zero absorbance readings. The ±% change is calculated with the first TN and TP calibration points (0 mg/L absorbance readings) of the applicable TN and TP calibration ranges in the CALIBRATION DATA menu. Refer to the TNmgu and TPmgu values in the reaction archive for the TN and TP zero absorbance readings.</p> <p>If the zero adjust values are within the TN BAND or TP BAND, the analyzer adjust the TN and TP zero adjust values at the end of the zero calibration. For the subsequent zero calibration, the zero tolerance is based on the first TN and TP calibration points adjusted with the previous zero adjust values.</p> <p>If the zero adjust values are not within the TN BAND or TP BAND, a 44_TN ZERO CAL FAIL or 45_TP ZERO CAL FAIL warning occurs at the end of a zero calibration. The analyzer does not change the zero adjust values. At the end of a zero check, a 47_TN ZERO CHCK FAIL or 48_TP ZERO CHCK FAIL warning occurs.</p>
SERVICE ZERO	<p>Sets the measurement interval (default: 20 measurements) and the number of zero calibrations (default: 5) for the SET SERVICE ZERO. Refer to the SET SERVICE ZERO setting in Enable automatic zero calibrations after service on page 7.</p>

The history of changes to the zero adjust values shows below the menu options. The history includes the zero adjust values with the date, time, zero range and zero type (calibration or check).

Descriptions of the codes shown follow:

- ZC—Zero calibration result
- ZK—Zero check result
- ZM—Zero adjust value set manually

1.6 Configure the span calibration settings

Set the basic and advanced span calibration settings (e.g., the calibration standard concentrations, operation range and tolerance limits for span calibrations and span checks). Show the history of changes to the span adjust values.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > SPAN PROGRAM.
2. Select an option.

Note: Some of the settings that follow are also changed on the CALIBRATION > SPAN CALIBRATION menu, which is used to change the basic span calibration settings.

Option	Description
SPAN PROGRAM	<p>Note: Do not change the default setting unless necessary. Changes can have a negative effect on the span adjust values.</p> <p>Sets the number of span reactions the analyzer does during a span calibration and a span check (default: 6).</p>
SPAN AVERAGE	<p>Note: Do not change the default setting unless necessary. Changes can have a negative effect on the span adjust values.</p> <p>Sets the number of reactions the analyzer uses to calculate the average value for the span adjust values (default: 3).</p>
RANGE	<p>Sets the operation range (1, 2 or 3) for span calibration reactions and span check reactions (default: 1). Select the operation range that agrees with normal measurements for the sample stream(s).</p> <p>Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</p> <p>Note: If the RANGE setting is not applicable to the STANDARD settings, the analyzer shows "CAUTION! REACTION RANGE OR STANDARD IS INCORRECT."</p>
TIC STANDARD TOC STANDARD	<p>Sets the concentrations of the TIC and TOC calibration standards for span calibrations (defaults: TIC = 200.0 mgC/L and TOC = 100.0 mgC/L). Enter concentrations that are 50% or more of the full scale value for the operation range selected in the RANGE setting. For example, if the operation range is 0 to 250 mgC/L, 50% of the full scale value is 125 mgC/L.</p> <p>If the calibration standard selected is 0.0 mg/L, the analyzer does not change the span adjust value for that parameter. In addition, the warning set with the TIC BAND and TOC BAND settings do not occur.</p> <p>Note: In VOC systems, do not do the TIC and TOC calibrations together. Do the TIC and TOC calibrations with different calibration standards.</p>
TIC BAND TOC BAND	<p>Sets the tolerance limits based on the last calibration (default: $\pm 25\%$) for the span calibration or span check results for TIC and TOC.</p> <p>If the average span result is not within the tolerance limits, a 30_TOC SPAN CAL FAIL, 31_TIC SPAN CAL FAIL, 33_TOC SPAN CHCK FAIL or 34_TIC SPAN CHCK FAIL warning occurs.</p>

Option	Description
TN STANDARD	Sets the concentrations of the TN and TP calibration standards for span calibrations (defaults: 50.0 mgN/L and 25.0 mgP/L).
TP STANDARD	Enter concentrations that are 50% or more of the full scale value for the operation range selected in the RANGE setting. For example, if the operation range is 0 to 250 mgC/L, 50% of the full scale value is 125 mgC/L. If one or more of the calibration standards selected is 0.0 mg/L, the analyzer does not change the span adjust values. In addition, the warnings set with the TN BAND and TP BAND settings do not occur.
TN BAND TP BAND	Sets the tolerance limits based on the last calibration (default: $\pm 25\%$) for the span calibration or span check results for TN and TP. If the average span result is not within the tolerance limits, a 36_TN SPAN CAL FAIL, 37_TP SPAN CAL FAIL, 39_TN SPAN CHCK FAIL or 40_TP SPAN CHCK FAIL warning occurs.

The history of changes to the span adjust values shows below the menu options. The history includes the span adjust values with the date, time, span range, span type (calibration or check) and the concentration of the standard solution.

Descriptions of the codes shown follow:

- SC—Span calibration result
- SK—Span check result
- SM—Span adjust set manually

1.7 Set the number of days between service

Set the number of days between service or reset the service counter.

1. Select MAINTENANCE > DIAGNOSTICS > SERVICE.
2. Select an option.

Option	Description
REACTION COUNTER	Shows the number of reactions.
SERVICE REQUIRED IN	Sets the number of days before the 83_SERVICE TIME warning occurs (default: 180 days = 6 months). <i>Note: The number of days on the service counter decreases when the analyzer is on, even when the analyzer is stopped.</i>
RESET SERVICE COUNTER	Sets the service counter to 180 (default). Select RESET SERVICE COUNTER after service is completed.

1.8 Enable automatic zero calibrations after service

Set the analyzer to automatically do zero calibrations after service is completed (when the service counter is reset).

1. Select MAINTENANCE > DIAGNOSTICS > SERVICE.
2. Select an option.

Option	Description
SET SERVICE ZERO	<p>Sets the analyzer to automatically do a number of zero calibrations (default: 5) at a set measurement interval (default: 20 measurements) after service is done.</p> <p>To unselect SET SERVICE ZERO, select RESET SERVICE ZERO.</p> <p>To change the number of zero calibrations done and the measurement interval, select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > ZERO PROGRAM > SERVICE ZERO.</p> <p>When service is done on some components, contamination can enter the component. The contamination can have an effect on measurements (e.g., in low range analyzers). A zero calibration should be done at intervals after service to adjust the zero offset values as the contamination is removed from the analyzer.</p> <p>Make sure to plumb the ZERO fitting to deionized water for zero calibrations. Approximately 500 mL of deionized water is used for a zero calibration or zero check.</p> <p>Note: If the analyzer is stopped when SET SERVICE ZERO is set to on, the analyzer does a zero calibration when the analyzer is started, then starts measurements.</p>
RESET SERVICE ZERO	<p>Unselects the SET SERVICE ZERO option. If RESET SERVICE ZERO is selected during a zero calibration, the analyzer goes to online operation after the zero calibration is completed.</p>

1.9 Set automatic calibrations and/or checks

Set the days and time when the analyzer does a span calibration, span check, zero calibration and/or zero check.

Make sure to plumb the calibration standard before a span calibration or span check is started. Refer to the Installation and Operation Manual for instructions.

Note: Do not keep standard solutions for a long period of time. The concentration of standard solutions changes over time.

Note: The line equalization function of the analyzer can contaminate the calibration standard. Contact technical support to set line equalization to off.

1. Select MAINTENANCE > COMMISSIONING > AUTOCAL PROGRAM.
2. Select an option.

Option	Description
TIME	<p>Sets the time (hh:mm) the analyzer does a span calibration, zero calibration, span check or zero check each day (default: 00:00, disabled).</p>
MONDAY–SUNDAY	<p>Sets the days the analyzer does a span calibration, zero calibration, span check or zero check (default: --, disabled).</p> <p>The first setting is the type of reaction. Options: Z (zero), S (span) or ZS (zero followed by span)</p> <p>The second setting selects a calibration or check. Options: CHECK or CAL</p> <p>For example, S CHECK sets the analyzer to do a span check. ZS CAL sets the analyzer to do a zero calibration and then a span calibration.</p>

1.10 Show the calibration curves

Set the number of decimal places that show in reaction results. Show the calibration curves for the three operation ranges for each parameter measured.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > CALIBRATION DATA.
2. Select an option.

Option	Description
DECIMAL PLACES	Sets the number of decimal places that show in the reaction results on the display and saved to the reaction archive (0, 1, 2 or 3).
TOC CALIBRATION 1–3	Shows the calibration curves for each parameter and operation range. For example, select TOC CALIBRATION 1 to see the TOC calibration curve for operation range 1.
TIC CALIBRATION 1–3	
TN CALIBRATION 1–3	
TP CALIBRATION 1–3	
	<ul style="list-style-type: none"> • First column—Number of calibration points • Second column—Calibration factors calculated from the calibration data • Third column—Concentration of the calibration standards. • Fourth column—Uncalibrated results measured and calculated from the CO₂ analyzer and dual cell photometer readings

1.11 Configure the fault settings

Set the conditions when faults and warnings occur. Do not change the settings.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > FAULT SETUP.
2. Select an option.

Option	Description
LOW O2 FLOW TIME	Sets a time limit for low oxygen flow. A 01_LOW O2 FLOW - EX or 02_LOW O2 FLOW - SO fault occurs if the oxygen flow decreases more than 50% of the mass flow controller (MFC) set value for more than the LOW O2 FLOW TIME setting (default: 12s).
HIGH O2 FLOW TIME	Sets a time limit for high oxygen flow. A 03_HIGH O2 FLOW fault occurs if the oxygen flow increases more than 50% of the mass flow controller (MFC) set value during a reaction for more than the HIGH O2 FLOW TIME setting (default: 20s).
BASE CO2 ALARM	Sets the high CO ₂ limit for zero calibrations and zero checks. A 52_HIGH CO ₂ IN BASE warning occurs if the CO ₂ reading is higher than the BASE CO ₂ ALARM setting (default: 1000ppm). When a 52_HIGH CO ₂ IN BASE warning occurs, the analyzer sets the zero adjust values at the end of the completed zero calibration.
CO2 ZERO LINE	Sets the CO ₂ zero value for the analyzer zero step (default: 0 ppm). AUTO (default)—The analyzer sets the CO ₂ ZERO LINE value during the analyzer zero step. M (manual)—The CO ₂ ZERO LINE setting is used. For example, if there is a CO ₂ leak into the source or detector sections of the CO ₂ analyzer, a 400 ppm CO ₂ level in the environment will increase the CO ₂ ZERO LINE level to approximately 250 ppm within 24 days of online operation or after approximately 5000 reactions.
CO2 ZERO ALARM	Sets the CO ₂ alarm limit for the analyzer zero step (default: 250 ppm). A 12_HIGH CO ₂ IN O ₂ fault occurs if the CO ₂ measured at the analyzer zero step for the oxygen gas input is more than the CO ₂ ZERO LINE setting plus the CO ₂ ZERO ALARM setting for three consecutive reactions. The CO ₂ zero alarm limit identifies an oxygen concentrator failure. If the oxygen concentrator has a failure, the oxygen purity will decrease and CO ₂ at atmospheric levels (approximately 400 ppm) will enter the analyzer. If a defective oxygen concentrator is used, water can enter the analyzer with the oxygen gas, which can cause damage to the mass flow controller.
SERVICE COUNTER	Sets the number of days before the 83_SERVICE TIME warning occurs (default: 180 days). The number of days on the service counter decreases when the analyzer is on, even when the analyzer is stopped. Note: Changes to the MAINTENANCE setting will change the MAINTENANCE > DIAGNOSTICS > SERVICE > SERVICE REQUIRED IN setting.
OZONE TEST TIME	Sets the time limit for the ozone test (default: 18s). The maximum setting is 60 seconds.

Option	Description
SAMPLE STATUS	<p>Sets the maximum time for sample detection (default: 5s). Sets the limit for the percent (%) sample quality (default: 75%).</p> <p>The SAMPLE STATUS is set to on when there is no sample for more than the sample detection time or when the sample quality is less than the % sample quality limit. For example, when there is a significant quantity of air bubbles in the sample stream and/or manual grab sample tubing. The SAMPLE STATUS relay changes when the sample sensor signal is received and does not change between reactions or when the analyzer stops or goes to standby mode.</p> <p>Note: To disable sample detection, select 0 seconds.</p>
SAMPLE FAULT 1 to 6	<p>Sets a time delay for the SAMPLE FAULT 1/2/3/4/5/6 relay and the 122/123/124/125/126/127_SAMPLE FAULT 1/2/3/4/5/6 notification (default: 100s). The time delay stops a sample fault that occurs for a short time from setting the SAMPLE FAULT 1 relay to on.</p>
AUTO RESET	<p>Sets the 122/123/124/125/126/127_SAMPLE FAULT 1/2/3/4/5/6 notification to be automatically acknowledged (YES) or to be acknowledged manually (NO, default).</p>
TEMPERATURE ALARM	<p>Sets the alarm limit for the analyzer temperature (default: 45 °C). A 53_TEMPERATURE ALARM warning occurs if the analyzer temperature is more than the alarm limit for more than 120 seconds.</p>

1.12 Configure the reaction check settings

Set the minimum CO₂ reading for a reaction. Set the CO₂ check limits for TIC analysis and TOC analysis. Do not change the settings.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > REACTION CHECK.
2. Select an option.

Option	Description
CO2 LEVEL	<p>Sets the minimum CO₂ reading for a reaction. Because there is organic and inorganic contamination in the analyzer reagents, each TOC reaction will have a small CO₂ reading from the reagents even when there is no sample present.</p> <p>The first setting is the minimum CO₂ reading (default: 100 ppm). The second reading is the CO₂ level mode (default: AUTO). AUTO (default)—The analyzer sets the CO2 LEVEL setting to 60% of the average CO₂ peak reading from the last zero calibration or zero check. MAN—The analyzer uses the CO2 LEVEL setting.</p> <p>If a CO₂ peak occurs at the incorrect step of the reaction and/or if the CO₂ peak is less than the CO2 LEVEL setting for the number of reactions in the REACTION COUNT setting, a 04_NO REACTION warning or a 04_NO REACTION fault occurs.</p> <p>Note: To disable the reaction check, select 0 ppm. When set to 0 ppm, a reaction check will not be done when a zero calibration or zero check is done.</p>
FAULT TYPE	<p>Set the fault type of the 04_NO REACTION alarm. Options: FAULT or WARNING (default).</p>
REACTION COUNT	<p>Sets the number of reactions for the 04_NO REACTION alarm (default: 3).</p>

Option	Description
TIC CHECK	Sets the CO ₂ check limit in the TIC analysis (default: 25 ppm). If the CO ₂ level is more than the TIC CHECK setting at the end of the TIC analysis, the analyzer increases the TIC SPARGE TIME for 1 second, then identifies the CO ₂ reading again. If the CO ₂ is not less than the TIC CHECK value after 300 seconds, a 50_TIC OVERFLOW warning occurs.
TOC CHECK	Sets the CO ₂ check limit in the TOC analysis (default: 100 ppm). If the CO ₂ level is more than the TOC CHECK setting at the end of the TOC oxidation step, the analyzer increases the TOC SPARGE TIME and TOC OXIDATION time for 1 second, then identifies the CO ₂ reading again. If the CO ₂ is not less than the TOC CHECK value after 300 seconds, a 51_TOC OVERFLOW warning occurs.

1.13 Set to demonstration mode

Set the analyzer to operate in demonstration mode as necessary. In demonstration mode, the CO₂ peaks that show on the display are simulations. The analyzer does not use reagents or carrier gas to operate while in demonstration mode.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > ANALYSIS MODE > DEMO MODE.
2. Select an option.

Option	Description
DEMO MODE	Sets demonstration mode to on. When OPERATION > START,STOP > START is selected, the analyzer operates in demonstration mode.
DEMO MODE CO2 DATA	Sets the height, width and time delays of the CO ₂ peaks that show on the display. CURVE PEAK —Sets the height of the CO ₂ peaks. CURVE WIDTH —Sets the width of the CO ₂ peaks. CURVE DELAY —Sets the time delays of the CO ₂ peaks.

1.14 Set the oxidation analysis mode

Set the oxidation analysis mode of a VOC system (TIC+TOC, TC or VOC).

Mechanical changes and system configuration changes are necessary to change the oxidation analysis mode if the analyzer is a TIC+TOC system. To set a specific analysis mode to on, the analyzer must be assembled and calibrated with the analysis mode at the factory.

Note: If the analysis mode is changed, the analyzer changes several configuration settings to the default settings.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > ANALYSIS MODE > OXIDATION ANALYSIS.
2. Select an option.

Option	Description
TIC+TOC	Sets the analyzer to measure the TIC contents and then the TOC contents of a sample. Only one sample is added to the reactor.
TC	Sets the analyzer to measure the TC content of a sample. The analyzer only adds one sample to the reactor.
VOC	Sets the analyzer to do two reactions: TC analysis mode and then TIC+TOC analysis mode. Two samples are added to the reactor.

3. Manually change the analyzer settings with the supplied configuration printout.

1.15 Set the liquid analysis mode

Set the liquid analysis mode (TN and TP) of the analyzer.

Note: If the analysis mode is changed, the analyzer changes several configuration settings to the default settings.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > ANALYSIS MODE > LIQUID ANALYSIS.
2. Select an analysis mode. Options: NONE, TN, TP or TN+TP (default). When NONE is selected, the analyzer does not measure TN or TP.

1.16 Configure Oxidation Program 1

Only change the oxidation analysis settings for operation range 1 with the aid of technical support.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > OXIDATION PROGRAM 1.
 - **TIC+TOC analysis mode**—Refer to [Table 1](#).
 - **TC analysis mode**—Refer to [Table 1](#) and [Table 2](#).
 - **VOC analysis mode**—Refer to [Table 1](#), [Table 2](#) and [Table 3](#).

Table 1 Oxidation Program 1—TIC+TOC settings

Option	Description
SAMPLE PUMP	Goes to MAINTENANCE > COMMISSIONING > SAMPLE PUMP. Refer to <i>Set the sample pump times</i> in the Installation and Operation Manual.
ANALYZER ZERO	Sets the analyzer zero time (default: 15s) and oxygen flow (default: 20 L/h). The CO ₂ analyzer identifies a zero offset level during the analyzer zero time. Note: At the analyzer zero step, a 12_HIGH CO ₂ IN O ₂ fault occurs if the CO ₂ analyzer reading is more than the CO ₂ ZERO LINE plus the CO ₂ ZERO ALARM value (default: 250 ppm) for three consecutive reactions.
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 1 (default: 6p). One pulse is ½ revolution of the pump roller. M–V (default)—Motorized-variable sample volume where the analyzer adds sample with the sample pump operation. M–F —Motorized-fixed volume sample volume where the analyzer adds sample with the 90° or 180° rotation of the sample (ARS) valve. For example, M-F90 and M-F180 sample injection types. Note: Calibrate the analyzer after the SAMPLE IN setting is changed.
TIC SPARGE TIME	Sets the TIC sparge time (default: 45s) and oxygen flow (default: 40 L/h). The analyzer sparges and measures the TIC content of the sample during the TIC sparge time. If the TIC level is not less than the TIC CHECK level (default: 100 ppm CO ₂) before the end of the TIC SPARGE TIME, the analyzer increases the time (extension time) until the TIC level is less than the 100 ppm level. Note: A 50_TIC OVERFLOW warning occurs if the TIC level is not less than 100 ppm before the end of the maximum extension time (300s). The maximum extension time cannot be changed.
TIC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TIC sparge step for operation range 1 (default: 3p).
BASE PURGE	Sets the quantity of base reagent (pulses) added to the reactor after 70% of the TIC sparge time is completed (default: 1p). Note: The base purge removes the small quantity of CO ₂ absorbed into the base tubing in the reactor during the TIC analysis.
PRE BASE OZONE	Sets the pre-base ozone time (default: 0s). After the TIC analysis, the ozone generator is set to on for the pre-base ozone time. Note: The pre-base ozone decreases the quantity of material that collects in the ozone destructor when the sample(s) contains high levels of ammonia.

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Table 1 Oxidation Program 1—TIC+TOC settings (continued)

Option	Description
BASE OXIDATION	Sets the base oxidation time (default: 300s) and the oxygen flow (default: 10 L/h). The analyzer oxidizes the sample during the base oxidation time. <i>Note: If CO₂ is released during the base oxidation time, the CO₂ is measured and added to the TOC result because the default setting of RESULT INTEGRATION is TOC+BASE OXID in the RESULT INTEGRATION menu.</i>
TOTAL BASE IN	Sets the quantity of base reagent (pulses) added to the reactor for operation range 1 (default: 15p). <i>Note: The total pulses of base reagent added during the base oxidation step is TOTAL BASE IN minus the BASE PURGE.</i>
TOC SPARGE TIME	Sets the TOC sparge time (default: 150s) and oxygen flow (default: 40 L/h). The analyzer sparges and measures the TOC content of the sample during the TOC sparge time. If the TOC level is not less than the TOC CHECK level (default: 350 ppm CO ₂) before the end of the TOC SPARGE TIME, the analyzer increases the time (extension time) until the TOC level is less than the 350 ppm level. <i>Note: A 51_TOC OVERFLOW warning occurs if the TOC level is not less than 350 ppm before the end of the maximum extension time (default: 300s). The maximum extension time cannot be changed.</i>
TOC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 1 (default: 15p).
TOC OXIDATION	Sets the time the ozone generator operates at the start of the TOC sparge step (default: 75s). <i>Note: The TOC oxidation time is part of the TOC sparge step and does not increase the TOC sparge time.</i>
REACTOR PURGE	Set the reactor purge time (default: 45s) and the oxygen flow (default: 80 L/h). The analyzer removes the contents of the reactor during the reactor purge time.
COOLER PURGE	Sets the cooler purge time (default: 1s). The analyzer removes the liquid that collects in the cooler during the cooler purge time.
PRESSURE CHECK	Sets the pressure test time (default: 25s). A pressure test pressurizes applicable components with oxygen gas at the end of each reaction to identify if there are air leaks. <i>Note: If the pressure check finds an air leak for a set number of consecutive reactions (default: 3), a 06_PRESSURE CHCK FAIL fault occurs. Refer to the PRESSURE CHCK COUNT setting in MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > PRESSURE/FLOW TEST.</i>
ANALYZER PURGE	Sets the analyzer purge time (default: 15s) and oxygen flow (default: 40L/h). The analyzer removes the contents of the CO ₂ analyzer during the analyzer purge time.
REACTION TIME	Shows the total reaction time for operation range 1.

Table 2 Oxidation Program 1—TC settings

Option	Description
PRE OXIDATION	Sets the pre-oxidation time (default: 45s) and oxygen flow (default: 10 L/h). The pre-oxidation time is the initial oxidation step. During the initial oxidation step, hydroxyl radicals are made for the VOC oxidation step.
BASE IN 1	Sets the quantity of base reagent (pulses) added to the reactor for the pre-oxidation step (default: 12p).
VOC OXIDATION	Sets the VOC oxidation time (default: 45s) and oxygen flow (default: 0 L/h). During VOC oxidation, the volatile organic carbon element of the sample oxidizes. <i>Note: VOC OXIDATION is set to 0 L/h to prevent the loss of volatiles before they are oxidized.</i>
BASE IN 2	Sets the quantity of base reagent (pulses) added to the reactor for the VOC oxidation step (default: 3p).

Table 3 Oxidation Program 1—VOC settings

Option	Description
SAMPLE PUMP FORWARD	Sets the forward operation time of the sample pump (default: 3s). The sample pump fills the sample (ARS) valve tubing with sample before the second sample injection into the reactor for the second TIC + TOC analysis reaction.

1.17 Configure Oxidation Program 2

Only change the oxidation analysis settings for operation range 2 with the aid of technical support.

- Select MAINTENANCE > SYSTEM CONFIGURATION > OXIDATION PROGRAM 2.
 - TIC+TOC analysis mode**—Refer to [Table 4](#).
 - TC analysis mode**—Refer to [Table 4](#) and [Table 5](#).
 - VOC analysis mode**—Refer to [Table 4](#) and [Table 5](#).

Table 4 Oxidation Program 2—TIC+TOC settings

Option	Description
RANGE CHANGE 1–2	Sets the concentration levels used by the analyzer to change the operation range automatically from operation range 1 to operation range 2. The RANGE CHANGE 1–2 setting is usually 50–100% of the highest concentration of operation range 1 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
RANGE CHANGE 1–3	Sets the concentration levels the analyzer uses to change the operation range automatically from operation range 1 to operation range 3. The RANGE CHANGE 1–3 setting is normally 50–75% of the highest concentration of operation range 2 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
RANGE CHANGE 2–1	Sets the concentration levels used by the analyzer to change the operation range automatically from operation range 2 to operation range 1. The RANGE CHANGE 2–1 setting is normally 40–50% of the highest concentration of operation range 1 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 2 (default: 2p). One pulse is ½ revolution of the pump roller. M–V (default)—Motorized-variable sample volume where sample is added with the sample pump operation. M–F —Motorized-fixed volume sample injection by the 90° or 180° rotation of the sample (ARS) valve. For example, M-F90 and M-F180 sample injection types. <i>Note: Calibration the analyzer after the SAMPLE IN setting is changed.</i>
TIC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for operation range 2 (default: 4p).
TOTAL BASE IN	Sets the quantity of base reagent (pulses) added to the reactor for operation range 2 (default: 23p).
TOC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 2 (default: 23p).

Table 5 Oxidation Program 2—TC settings

Option	Description
BASE IN 1	Sets the quantity of base reagent (pulses) added to the reactor at the pre-oxidation step for operation range 2 (default: 12p).
BASE IN 2	Sets the quantity of base reagent (pulses) added to the reactor at the VOC oxidation step for operation range 2 (default: 3p).

1.18 Configure the Oxidation Program 3

Only change the oxidation analysis settings for operation range 3 with the aid of technical support.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > OXIDATION PROGRAM 3.
 - **TIC+TOC analysis mode**—Refer to [Table 6](#).
 - **TC analysis mode**—Refer to [Table 6](#) and [Table 7](#).
 - **VOC analysis mode**—Refer to [Table 6](#) and [Table 7](#).

Table 6 Oxidation Program 3—TIC+TOC settings

Option	Description
RANGE CHANGE 2–3	Sets the concentration levels used by the analyzer to change the operation range automatically from operation range 2 to operation range 3. The RANGE CHANGE 2–3 setting is usually 50–100% of the highest concentration of operation range 2 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
RANGE CHANGE 3–2	Sets the concentration levels used by the analyzer to change the operation range automatically from operation range 3 to operation range 2. The RANGE CHANGE 3–2 setting is normally 40–50% of the highest concentration of operation range 2 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
RANGE CHANGE 3–1	Sets the concentration levels used by the analyzer to change the operation range automatically from operation range 3 to operation range 1. The RANGE CHANGE 3–1 setting is normally 40–50% of the highest concentration of operation range 1 for TOC, TN and TP. <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 3 (default: 0p). M–V —Motorized-variable sample volume where sample is added with the sample pump operation. MF–180 (default)—Motorized-fixed volume sample injection by the 180° rotation of the sample (ARS) valve. When SAMPLE IN is set to 0p, no sample is added to the reactor. Instead acid reagent (or base reagent) and oxygen gas is used to add the fixed volume of sample that is in the sample (ARS) valve. <i>Note: Calibration the analyzer after the SAMPLE IN setting is changed.</i>
TIC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for operation range 3 (default: 5p).
TOTAL BASE IN	Sets the quantity of base reagent (pulses) added to the reactor at the base oxidation step for operation range 3 (default: 31p).
TOC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 3 (default: 31p).

Table 7 Oxidation Program 3—TC settings

Option	Description
BASE IN 1	Sets the quantity of base reagent (pulses) added to the reactor at the pre-oxidation step for operation range 3 (default: 12p).
BASE IN 2	Sets the quantity of base reagent (pulses) added to the reactor at the VOC oxidation step for operation range 3 (default: 3p).

1.19 Configure the liquid phase program

Only change the liquid analysis settings (TN and TP) with the aid of technical support.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > LIQUID PHASE PROGRAM.
2. Select an option.

Option	Description
TP SMPL VOLUME	Sets the volume of oxidized sample used for TP analysis (default: 3.2 mL).
WAIT FOR SMPL	Sets the delay time that occurs when the reactor purge of the oxidized sample completes (default: 5s).
SAMPLE RETURN	Sets the reverse operation time (pulses) of the nitrogen pump to send the oxidized sample back into the oxidized sample catch-pot (OSCP)/cleaning vessel after the TN measurement (default: 28p, 13s).
SMPL LOOP FILL	Sets the forward operation time (pulses) of the nitrogen pump to fill the sample loop with oxidized sample (default: 14p, 6s). The sample loop is normally 1.5 m of tubing between the NP sample valve and the sample loop valve.
SMPL LOOP PURGE	Sets the forward operation time (pulses) of the phosphorus pump to remove the oxidized sample content from the sample loop and the related tubing (default: 16p, 7s). The phosphorous pump moves the oxidized sample content into the heated mixer and bubble remover (TPr boiler).
TN SMPL FETCH	Sets the forward operation time of the nitrogen pump to fill the TN measuring cell for the TN measurement (default: 19p, 9s).
TN SMPL MEASURE	Sets the number of TN measurements done on the sample (default: 3).
TN SMPL CELL SHIFT	Sets the forward operation time of the nitrogen pump to move the sample content of the TN measuring cell before each measuring cycle (default: 1p, 0s). The nitrogen pump moves the sample content to remove bubbles in the TN measuring cell.
TPr SMPL FETCH	Sets the forward operation time of the phosphorus pump when a fixed quantity of oxidized sample is added to the TPr boiler (default: 32p, 15s).
TPr SMPL-RGNT MIX	Sets the reaction time when the TP reagent and oxidized sample are mixed and kept in the TPr boiler (default: 60s).
TPr SMPL CELL SHIFT	Sets the reverse operation time of the phosphorus pump to move the sample content of the TP measuring cell before each measuring cycle (default: 1p, 0s). The phosphorous pump moves the sample content to remove bubbles in the TP measuring cell.
TP SMPL FETCH	Sets the forward operation time of the phosphorus pump to move the hydrolyzed sample from the TP boiler to the TPr boiler (default: 42p, 20s).

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Option	Description
TP SMPL-RGNT MIX	Sets the forward operation time of the phosphorus pump to mix the hydrolyzed sample with the TP reagent (default: 20s).
TP SMPL MEASURE	Sets the number of TP measurements done on the sample (default: 3).
TP SMPL CELL SHIFT	Sets the reverse operation time of the phosphorus pump to move the sample content of the TP measuring cell before each measuring cycle (default: 1p, 0.5s). The phosphorous pump moves the sample content to remove bubbles in the TP measuring cell.
RGNT-MIXER FILL	Sets the forward operation time of the TP reagent pump to add the TP reagent into the TPr boiler (default: 8p, 4s).
HCl-MIXER FILL	Sets the forward operation time of the HCl acid pump to add the HCl acid reagent into the TPr boiler (default: 8p, 4s).
MIXING ON	Sets the forward operation time of the phosphorus pump to mix the TP reagent (or HCl acid) with the related oxidized sample or hydrolyzed sample (default: 12p, 5s).
MIXING OFF	Sets the pause time of the phosphorus pump to hold the related mixing process (TP reagent with hydrolyzed sample or HCl acid reagent with oxidized sample) in the TPr boiler (default: 10s).
MIXER PURGE	Sets the reverse operation time of the phosphorus pump to move the sample through the boiler valve and into the glass drain chamber (default: 42p, 20s).
MIXER-BOIL PURGE	Sets the reverse operation time of the phosphorus pump to move the sample through the TP boiler and into the glass drain chamber (default: 50p, 24s).
MIXER-P CELL FILL	Sets the reverse operation time of the phosphorus pump to fill the TP measuring cell with TP sample (default: 13p, 6s).
MIXER-BOILER FILL	Sets the reverse operation time of the phosphorus pump to add the oxidized sample and HCl acid mix into the TP boiler (default: 21p, 10s).
BOILER-MIXER FILL	Sets the forward operation time of the phosphorus pump to put the hydrolyzed sample into the TPr boiler (default: 52p, 25s).
N CELL PURGE	Sets the reverse operation time of the nitrogen pump to remove the contents of the TN measuring cell (default: 35p, 16s).
P CELL PURGE	Sets the forward operation time of the phosphorus pump to remove the contents of the TP measuring cell (default: 35p, 16s).
OSCP PURGE	Sets the forward operation time of the nitrogen pump to make the oxidized sample catch-pot/cleaning vessel empty (default: 75p, 36s).
OSCP LINE PURGE	Sets the reverse operation time of the sample pump to remove the remaining sample from the oxidized sample catch-pot/cleaning vessel (default: 2s).
CLEAN-MIXER LOAD	Sets the forward operation of the phosphorus pump and the activation time of the TN cleaning valve to take a batch of TN cleaning solution (default: 18p, 8s) .
CLEAN-MIXER FILL	Sets the forward operation time of the phosphorus pump to put the batch of TN cleaning solution into the TPr boiler (default: 34p, 16s).
CLEAN-N CELL FILL	Sets the forward operation time of the nitrogen pump to clean the TN measuring cell (default: 21p, 10s).
CLEAN-P CELL FILL	Sets the reverse operation time of the phosphorus pump to clean the TP measuring cell (default: 12p, 5s).

Option	Description
CL-SMPL LINE FILL	Sets the reverse operation time of the nitrogen pump to put the TN cleaning solution that is in the TN measuring cell into the oxidized sample catch-pot/cleaning vessel (default: 9p, 4s).
CL-SMPL LINE PURGE	Sets the forward operation time of the nitrogen pump to move the TN cleaning solution from the oxidized sample catch-pot and to put it back into the TN measuring cell (default: 12p, 5s).
WASH CYCLES	Sets the number of deionized (DI) water washing cycles, which are done after the TN cleaning cycle (default: 2).
WASH-MIXER LOAD	Sets the forward operation time of the phosphorus pump and the DI water valve activation time (default: 22p, 10s).
WASH-MIXER FILL	Sets the forward operation time of the phosphorus pump to put the DI water into the TPr boiler (default: 38p, 18s).
WASH-N CELL FILL	Sets the forward operation time of the nitrogen pump to wash the TN measuring cell with DI water (default: 23p, 11s).
WASH-P CELL FILL	Sets the reverse operation time of the phosphorus pump to flush the TP measuring cell with DI water (default: 15p, 7s).
W-SMPL LINE FILL	Sets the reverse operation time of the nitrogen pump to move the DI water from the TN measuring cell to the oxidized sample catch-pot/cleaning vessel (default: 12p, 5s).
W-SMPL LINE PURGE	Sets the forward operation time of the nitrogen pump to move the DI water from the oxidized sample catch-pot to the TN measuring cell (default: 16p, 7s).
DIW-MIXER LOAD	Sets the forward operation time of the phosphorus pump and the DI water valve activation time (default: 26p, 12s).
DIW-MIXER FILL	Sets the forward operation time of the phosphorus pump to put the DI water into the TPr boiler (default: 38p, 18s).
DIW-N CELL FILL	Sets the forward operation time of the nitrogen pump to fill the TN measuring cell with DI water (default: 21p, 10s).
DIW-P CELL FILL	Sets the reverse operation time of the phosphorus pump to fill the TP measuring cell with DI water (default: 14p, 6s).
DIW MEASURE	Sets the number of DI water reference measurements done on the DI water in the TN and TP measuring cells at the applicable wavelengths (default: 3).
DIW CELL SHIFT	Sets the reverse operation time of the phosphorus pump and the forward operation time of the nitrogen pump to move the DI water into the measuring cells (default: 1p, 0s). The phosphorous pump moves the DI water before each DI water reference cycle to remove bubbles in the measuring cells.

1.20 Configure the cleaning program

Configure the cleaning program to set the operation of the cleaning cycle. During the cleaning cycle, the sample pump operates in reverse to move the oxidized sample liquid from the catch-pot back through the sample inlet tubing and out of the analyzer.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > CLEANING PROGRAM.
2. Select an option.

Option	Description
CLEANING START	Sets when a oxidation phase cleaning cycle is done. FIRST (default)—Before the number of reactions selected in CLEANING PERIOD, a cleaning cycle is done. LAST —After the number of reactions selected in CLEANING PERIOD, a cleaning cycle is done.
CLEANING PERIOD	Sets the number of reactions between each oxidation phase cleaning cycle (default: 1, 1). The first number is the number of reactions between each cleaning cycle. The second number is the number of cleaning cycles done. <i>Note: To disable the cleaning cycle, select 0, 1.</i>
CLEANING HIGH	Sets the number of reactions between each oxidation phase cleaning cycle when the TOC results is more than the CLEANING HIGH AL setting (default: 0).
CLEANING HIGH AL	Sets the TOC result for the CLEANING HIGH setting (default: 1000.0 mgC/L).

3. Scroll down to LIQUID PHASE CLEANING.
4. Select an option.

Option	Description
CLEANING START	Sets when a liquid phase cleaning cycle is done. FIRST —Before the number of reactions selected in CLEANING PERIOD, a cleaning cycle is done. LAST (default)—After the number of reactions selected in CLEANING PERIOD, a cleaning cycle is done.
CLEANING PERIOD	Sets the number of TN and TP reactions between each liquid phase cleaning cycle (default: 50, 1). The first number is the number of reactions between each cleaning cycle. The second number is the number of cleaning cycles done. <i>Note: To disabled the cleaning cycle, select 0, 1.</i>

1.21 Configure the reagent purge cycle

Configure the reagent purge settings. A reagent purge is done when START NEW REAGENT CYCLE, PURGE REAGENTS & ZERO or RUN REAGENTS PURGE is selected.

Do a reagent purge to move reagents through the reagent tubing to remove air bubbles and blockages.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SEQUENCE PROGRAM > REAGENTS PURGE.
2. Select an option.

Option	Description
ACID&BASE PURGE	Sets the total operation time of the acid and base pumps to prime the reagents during the INSTALL NEW REAGENTS cycle (default: 150s).

Option	Description
TN CLEANING PURGE	Sets the pump operation time (pulses) for the TN cleaning solution (default: 42p, 20s).
DI WATER PURGE	Sets the pump operation time (pulses) for the DI water (default: 42p, 20s).
TP REAGENT PURGE	Sets the pump operation time (pulses) for the TP reagent (default: 67p, 40s).
HCl ACID PURGE	Sets the pump operation time (pulses) for the HCl acid (default: 67p, 40s).

1.22 Configure the CO₂ analyzer settings

Set the connection type and baudrate for the CO₂ analyzer. Set the measurement range of the CO₂ analyzer. Set the zero and span calibration values to calibrate the CO₂ analyzer.

Only change the ANALYSIS GRAPH SCALE setting. Do not change the other settings.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > CO₂ ANALYZER.
2. Select an option.

Option	Description
ANALYSIS GRAPH SCALE	Sets the full scale of the analysis graph on the Reaction Graph screen (default: 10000 ppm).
INTERFACE	Sets the connection type of the CO ₂ analyzer to analog (4–20 mA, default) or digital (RS232).
BAUDRATE	Sets the data communication signaling speed of the CO ₂ analyzer when INTERFACE is set to RS232 (default: 9600).
CO₂ ANALYZER RANGE	Sets the full scale range of the CO ₂ analyzer (default: 10000 ppm).
CO₂ ANALYZER CAL	Sets the CO ₂ analyzer range and the CO ₂ analyzer zero and span calibration values. Please contact technical support if changes to the calibration values are necessary.

1.23 Configure the cooler settings

Set the cooler setpoint temperature and operation mode. Set the cooler control operation.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > COOLER PROGRAM.
2. Select an option.

Option	Description
COOLER	<p>Sets the cooler setpoint temperature (default: 16 °C) and the operation mode (default: DIFF).</p> <p>DIFF (differential temperature mode)—The cooler setpoint is the ambient temperature, which is the analyzer temperature minus the COOLER setting. For example, if the analyzer temperature is 20 °C, the cooler setpoint is 4 °C when the COOLER setting is 16 °C.</p> <p>F (fixed temperature mode)—The cooler setpoint is a fixed temperature (e.g., 5 °C).</p> <p>B(backup mode)—The cooler is controlled by the fixed PWM (pulse width modulation) operation.</p> <p><i>Note: The cooler operates in backup mode when a cooler fault occurs. A 54_COOLER LOW TEMP warning occurs if the cooler temperature is less than 2 °C (35.6 °F) for more than 600 seconds. A 55_COOLER HIGH TEMP warning occurs if the cooler temperature is 5 °C (9 °F) more than the cooler setpoint temperature and more than 8 °C (14 °F) below the ambient temperature for more than 600 seconds. Backup mode is cancelled when the fault is acknowledged.</i></p>
BACKUP PWM	<p>Sets the cooler control operation (default: 30%), which uses a PWM (pulse width modulation) period of 10 seconds to get to the cooler setpoint temperature for all of the cooler operation modes. For example, when BACKUP PWM is set to 30%, the cooler is set to on for 3 seconds and then set to off for 7 seconds.</p> <p>When a cooler fault occurs, the cooler operates in backup mode. In backup mode, the cooler is controlled by the fixed PWM operation. In backup mode, the COOLER settings and the temperature sensor information are ignored.</p>

1.24 Configure the boiler settings

Set the boiling time and boiler temperature. Set the maximum time for the boiler to get to the setpoint temperature before a fault occurs.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > BOILER PROGRAM.
2. Select an option.

Option	Description
TP BOILING	<p>Sets the time the analyzer keeps the TP sample in the TP boiler (default: 360s).</p>
TP BOILER TEMP	<p>Sets the operation setpoint temperature for the TP boiler (default: 95 °C) and the standby/stopped setpoint temperature (default: 95 °C). The first setting is the operation temperature and the second setting is the standby/stopped temperature.</p> <p><i>Note: A 58_TP BOILER FAULT warning occurs and the boiler is set to off (fault mode) if the TP boiler temperature is more than 115 °C or less than 10 °C for more than 120 seconds.</i></p>
TPr BOILER TEMP	<p>Sets the operation setpoint temperature for the TPr boiler (default: 48 °C) and the standby/stopped setpoint temperature (default: 48 °C). The first setting is the operation temperature and the second setting is the standby/stopped temperature. The TPr boiler is the heated mixer and bubble remover.</p> <p><i>Note: A 61_TPr BOILER FAULT warning occurs and the boiler is set to off (fault mode) if the TPr boiler temperature is more than 115 °C or less than 10 °C for more than 120 seconds.</i></p>

Option	Description
TP BOILER ALARM	<p>Sets the maximum time for the TP boiler to increase to the operation or standby/stop setpoint temperatures (default: 1500s). Sets the temperature band (default: 8 °C). To disable the TP boiler alarm, select 0 seconds and 0 °C.</p> <p>Note: A <i>57_TP BOIL LO TEMP</i> or <i>56_TP BOIL HI TEMP</i> warning occurs if the statements that follow are true:</p> <ul style="list-style-type: none"> • The TP boiler does not increase to the operation or standby/stop setpoint temperatures within the maximum time of the TP BOILER ALARM setting. • The operation and standby/stop temperatures are not within the temperature band (\pm °C) of the TP BOILER ALARM setting for longer than the maximum time setting of TP BOILER ALARM.
TPr BOILER ALARM	<p>Sets the maximum time for the TPr boiler to increase to the operation or standby/stop setpoint temperatures (default: 1500s). Sets the temperature band (default: 8 °C). To disable the TPr boiler alarm, select 0 seconds and 0 °C.</p> <p>Note: A <i>60_TPr BOIL LO TEMP</i> or <i>59_TPr BOIL HI TEMP</i> warning occurs if the statements that follow are true:</p> <ul style="list-style-type: none"> • The TPr boiler does not increase to the operation or standby/stop setpoint temperatures within the maximum time of the TPr BOILER ALARM setting. • The operation and standby/stop temperatures are not within the temperature band (\pm °C) of the TPr BOILER ALARM setting for longer than the maximum time setting of TPr BOILER ALARM.

1.25 Hardware configuration

The MAINTENANCE > SYSTEM CONFIGURATION > HARDWARE CONFIGURATION menus are for factory use only.

Section 2 4-20 mA output modes

Set the 4–20 mA outputs to one of the three modes that follow:

- **DIRECT** (direct mode)—Each channel (4-20 mA output) shows a specified stream (STREAM 1) and result type (e.g., TOC).
- **STREAM MUX** (stream multiplex mode)—Channel 1 identifies the stream (e.g., STREAM 1). Channels 2 to 6 are configured to show one result type each (e.g., TOC). Channels 2 to 6 show the results for the streams in the OUTPUT 1 to 6 settings.
- **FULL MUX** (full multiplex mode)—Only four channels are necessary to show all of the result types from all of the streams. Channel 1 identifies the stream (e.g., STREAM 1). Channel 2 identifies the result type (e.g., TOC). Channel 3 shows the streams and result types in the OUTPUT 1 to 6 settings. Channel 4 shows the 24-average results for the streams and result types in the OUTPUT 1 to 6 settings.

A small amount of processing (normally with a programmable logic controller) is necessary when a multiplex mode is used.

2.1 Stream multiplex mode

In stream multiplex mode, Channel 1 (4–20 mA Output 1) changes its 4–20 mA signal at regular intervals to identify the sample stream or manual (grab sample) stream¹. Refer to [Table 8](#).

Channels 2 to 6 (4–20 mA Outputs 2 to 6) each show one result type (e.g., TIC, TOC) as configured in the CHANNEL settings. Refer to *Configure the 4–20 mA outputs* in the Installation and Operation Manual. Channels 2 to 6 change at 20 second intervals (default).

The sequence is as follows:

1. The 4-20mA READ relay is set to off. Channel 1 is set to 4 mA (change level).
2. Wait the configured time delay (SIGNAL HOLD TIME, default: 10 seconds).
3. Channels 2 to 6 show the sample stream results identified in the OUTPUT settings in the 4-20mA PROGRAM menu.
4. Channel 1 is set to the first sample stream (STREAM 1).
5. Wait 1 second.
6. The 4-20mA READ relay is set to on.
7. Wait the configured time delay (SIGNAL HOLD TIME, default: 10 seconds).
8. Steps 1 to 7 are done again for each sample stream (e.g., STREAM 2) and manual stream (MANUAL 1). When done, continue to step 9.
9. The 4-20mA READ relay is set to off. Channel 1 is set to 4 mA (change level).
10. Wait for a new result or the configured time (update period), then go to step 2.

Since the channel signals in stream multiplex mode change at regular intervals, it is necessary to get the analyzer and the external device that receives the channel signals synchronized. Use one of the two signals that follow to get the analyzer and the external device synchronized:

- Channel 1 (analog output)
- 4-20mA READ relay (digital output)

The 4-20mA READ relay is set to on 1 second after the 4–20 mA signals change on Channels 1–6. Configure one relay to be a 4-20mA READ relay, refer to *Configure the relays* in the Installation and Operation Manual.

When Channel 1 is set to 4 mA (change level) and the 4-20mA READ signal is set to off, the Channel 2 to 6 signals stay at the last value.

¹ The stream identification channel (Channel 1) identifies the sample stream for the first 10 seconds (default), then goes to 4 mA (change level) for 10 seconds (default).

Table 8 Channel 1 signals

Stream	Output	Stream	Output
Change level	4 mA	MANUAL 3	13 mA
STREAM 1	5 mA	MANUAL 4	14 mA
STREAM 2	6 mA	MANUAL 5	15 mA
STREAM 3	7 mA	MANUAL 6	16 mA
STREAM 4	8 mA	CAL	17 mA
STREAM 5	9 mA	CAL Z	18 mA
STREAM 6	10 mA	CAL S	19 mA
MANUAL 1	11 mA	Reserved	20 mA
MANUAL 2	12 mA		

2.2 Full multiplex mode

In full multiplex mode, only three 4–20 mA outputs are necessary to show all of the result types for all of the sample streams and manual (grab sample) streams.

Channel 1 (4–20 mA Output 1) changes its 4–20 mA signal at regular intervals to identify the sample stream or manual (grab sample) stream². Refer to [Table 8](#) on page 26.

Channel 2 (4–20 mA Output 2) changes its 4–20 mA signal at the same interval as Channel 1 to identify the result type³ (e.g., TIC). Refer to [Table 9](#).

Channel 3 (4–20 mA Output 3) is the INST result channel. Channel 3 shows the result at the end of each reaction for 20 seconds (default).

Channel 4 (4–20 mA Output 4) is the AVRG result channel. Channel 4 shows the 24-hour average result. The Channel 4 signal changes at the AVERAGE UPDATE time selected in SYSTEM CONFIGURATION > SEQUENCE PROGRAM > AVERAGE PROGRAM.

The sequence is as follows:

1. The 4-20mA READ relay is set to off. Channel 1 and Channel 2 are set to 4 mA (change level and not defined level).
2. Wait the configured time delay (SIGNAL HOLD TIME, default: 10 seconds).
3. Channel 2 is set to the first result type (TIC).
4. Channel 3 and 4 show the stream reaction result.
5. Channel 1 is set to the first sample stream (STREAM 1).
6. Wait 1 second.
7. The 4-20mA READ relay is set to on.
8. Wait the configured time delay (SIGNAL HOLD TIME, default: 10 seconds).
9. Steps 1 to 8 are done again for each result type. When done, continue to step 10.
10. Steps 1 to 9 are done again for each sample stream (e.g., STREAM 2) and manual stream (MANUAL 1). When done, continue to step 11.
11. The 4-20mA READ relay is set to off. Channel 1 and Channel 2 are set to 4 mA (change level and not defined level).
12. Wait for a new result or the configured time (update period), then go to step 2.

Since the channel signals in stream multiplex mode change at regular intervals, it is necessary to get the analyzer and the external device that receives the channel signals

² The stream identification channel (Channel 1) identifies the sample stream for the first 10 seconds (default), then goes to 4 mA (change level) for 10 seconds (default).

³ The result type channel (Channel 2) identifies the result type for the first 10 seconds (default), then goes to 4 mA (not defined level for 10 seconds).

synchronized. Use one of the two signals that follow to get the analyzer and the external device synchronized:

- Channel 1 (analog output)
- 4-20mA READ relay (digital output)

The 4-20mA READ relay is set to on 1 second after the 4–20 mA signals change on Channels 1–6. Configure one relay to be a 4-20mA READ relay, refer to *Configure the relays* in the Installation and Operation Manual.

When Channel 1 is set to 4 mA (change level) and the 4-20mA READ signal is set to off, the Channel 3 and 4 signals stay at the last value.

Table 9 Channel 2 signals

Result type	Output	Result type	Output
Not defined level	4 mA	Not used	10 mA
TIC	5 mA	TP	11 mA
TOC	6 mA	Reserved	12 mA
TC	7 mA	Reserved	13 mA
VOC	8 mA	Reserved	14 mA
TN	9 mA	Reserved	15 to 20 mA

Section 3 Modbus register maps

3.1 Measurement registers

Stream 1 measurements

Name	Description	Register	Data type
STREAM_1_RLOG_TIC	Stream 1: Last total inorganic carbon measurement	40001, 40002	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_1_RLOG_TOC	Stream 1: Last total organic carbon measurement	40003, 40004	
STREAM_1_RLOG_TC	Stream 1: Last total carbon measurement	40005, 40006	
STREAM_1_RLOG_VOC	Stream 1: Last volatile organic carbon measurement	40007, 40008	
STREAM_1_RLOG_TN	Stream 1: Last total nitrogen measurement	40009, 40010	
STREAM_1_RLOG_TP	Stream 1: Last total phosphorus measurement	40011, 40012	
STREAM_1_RLOG_COD	Stream 1: Last chemical oxygen demand measurement	40013, 40014	
STREAM_1_RLOG_BOD	Stream 1: Last biochemical oxygen demand measurement	40015, 40016	
STREAM_1_RLOG_TPR	Stream 1: Last total reactive and organic phosphorus measurement	40025, 40026	

Note: When a register is read, the value in the `_TIME` register for that register (e.g., `STREAM_1_RLOG_TIC_TIME`) is updated.

Stream 2 measurements

Name	Description	Register	Data type
STREAM_2_RLOG_TIC	Stream 2: Last total inorganic carbon measurement	40029, 40030	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_2_RLOG_TOC	Stream 2: Last total organic carbon measurement	40031, 40032	
STREAM_2_RLOG_TC	Stream 2: Last total carbon measurement	40033, 40034	
STREAM_2_RLOG_VOC	Stream 2: Last volatile organic carbon measurement	40035, 40036	
STREAM_2_RLOG_TN	Stream 2: Last total nitrogen measurement	40037, 40038	
STREAM_2_RLOG_TP	Stream 2: Last total phosphorus measurement	40039, 40040	
STREAM_2_RLOG_COD	Stream 2: Last chemical oxygen demand measurement	40041, 40042	
STREAM_2_RLOG_BOD	Stream 2: Last biochemical oxygen demand measurement	40043, 40044	
STREAM_2_RLOG_TPR	Stream 2: Last total reactive and organic phosphorus measurement	40053, 40054	

Note: When a register is read, the value in the `_TIME` register for that register (e.g., `STREAM_1_RLOG_TIC_TIME`) is updated.

Modbus register maps

Stream 3 measurements

Name	Description	Register	Data type
STREAM_3_RLOG_TIC	Stream 3: Last total inorganic carbon measurement	40057, 40058	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_3_RLOG_TOC	Stream 3: Last total organic carbon measurement	40059, 40060	
STREAM_3_RLOG_TC	Stream 3: Last total carbon measurement	40061, 40062	
STREAM_3_RLOG_VOC	Stream 3: Last volatile organic carbon measurement	40063, 40064	
STREAM_3_RLOG_TN	Stream 3: Last total nitrogen measurement	40065, 40066	
STREAM_3_RLOG_TP	Stream 3: Last total phosphorus measurement	40067, 40068	
STREAM_3_RLOG_COD	Stream 3: Last chemical oxygen demand measurement	40069, 40070	
STREAM_3_RLOG_BOD	Stream 3: Last biochemical oxygen demand measurement	40071, 40072	
STREAM_3_RLOG_TPR	Stream 3: Last total reactive and organic phosphorus measurement	40081, 40082	

Note: When a register is read, the value in the `_TIME` register for that register (e.g., `STREAM_1_RLOG_TIC_TIME`) is updated.

Stream 4 measurements

Name	Description	Register	Data type
STREAM_4_RLOG_TIC	Stream 4: Last total inorganic carbon measurement	40085, 40086	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_4_RLOG_TOC	Stream 4: Last total organic carbon measurement	40087, 40088	
STREAM_4_RLOG_TC	Stream 4: Last total carbon measurement	40089, 40090	
STREAM_4_RLOG_VOC	Stream 4: Last volatile organic carbon measurement	40091, 40092	
STREAM_4_RLOG_TN	Stream 4: Last total nitrogen measurement	40093, 40094	
STREAM_4_RLOG_TP	Stream 4: Last total phosphorus measurement	40095, 40096	
STREAM_4_RLOG_COD	Stream 4: Last chemical oxygen demand measurement	40097, 40098	
STREAM_4_RLOG_BOD	Stream 4: Last biochemical oxygen demand measurement	40099, 40100	
STREAM_4_RLOG_TPR	Stream 4: Last total reactive and organic phosphorus measurement	40103, 40104	

Note: When a register is read, the value in the `_TIME` register for that register (e.g., `STREAM_1_RLOG_TIC_TIME`) is updated.

Stream 5 measurements

Name	Description	Register	Data type
STREAM_5_RLOG_TIC	Stream 5: Last total inorganic carbon measurement	40107, 40108	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_5_RLOG_TOC	Stream 5: Last total organic carbon measurement	40109, 40110	
STREAM_5_RLOG_TC	Stream 5: Last total carbon measurement	40111, 40112	
STREAM_5_RLOG_VOC	Stream 5: Last volatile organic carbon measurement	40113, 40114	
STREAM_5_RLOG_TN	Stream 5: Last total nitrogen measurement	40115, 40116	
STREAM_5_RLOG_TP	Stream 5: Last total phosphorus measurement	40117, 40118	
STREAM_5_RLOG_COD	Stream 5: Last chemical oxygen demand measurement	40119, 40120	
STREAM_5_RLOG_BOD	Stream 5: Last biochemical oxygen demand measurement	40121, 40122	
STREAM_5_RLOG_TPR	Stream 5: Last total reactive and organic phosphorus measurement	40125, 40126	

Note: When a register is read, the value in the _TIME register for that register (e.g., STREAM_1_RLOG_TIC_TIME) is updated.

Stream 6 measurements

Name	Description	Register	Data type
STREAM_6_RLOG_TIC	Stream 6: Last total inorganic carbon measurement	40129, 40130	float, read only -1.0 ⁶ to 1.0 ⁶
STREAM_6_RLOG_TOC	Stream 6: Last total organic carbon measurement	40131, 40132	
STREAM_6_RLOG_TC	Stream 6: Last total carbon measurement	40133, 40134	
STREAM_6_RLOG_VOC	Stream 6: Last volatile organic carbon measurement	40135, 40136	
STREAM_6_RLOG_TN	Stream 6: Last total nitrogen measurement	40137, 40138	
STREAM_6_RLOG_TP	Stream 6: Last total phosphorus measurement	40139, 40140	
STREAM_6_RLOG_COD	Stream 6: Last chemical oxygen demand measurement	40141, 40142	
STREAM_6_RLOG_BOD	Stream 6: Last biochemical oxygen demand measurement	40143, 40144	
STREAM_6_RLOG_TPR	Stream 6: Last total reactive and organic phosphorus measurement	40147, 40148	

Note: When a register is read, the value in the _TIME register for that register (e.g., STREAM_1_RLOG_TIC_TIME) is updated.

3.2 Measurement time registers

Stream 1 measurement times

Name	Description	Register	Data type
STREAM_1_RLOG_TIC_TIME	Stream 1 Time and date of the last total inorganic carbon measurement	40300, 40301	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_1_RLOG_TOC_TIME	Stream 1 Time and date of the last total organic carbon measurement	40302, 40303	
STREAM_1_RLOG_TC_TIME	Stream 1 Time and date of the last total carbon measurement	40304, 40305	
STREAM_1_RLOG_VOC_TIME	Stream 1 Time and date of the last volatile organic carbon measurement	40306, 40307	
STREAM_1_RLOG_TN_TIME	Stream 1 Time and date of the last total nitrogen measurement	40308, 40309	
STREAM_1_RLOG_TP_TIME	Stream 1 Time and date of the last total phosphorus measurement	40310, 40311	
STREAM_1_RLOG_COD_TIME	Stream 1 Time and date of the last chemical oxygen demand measurement	40312, 40313	
STREAM_1_RLOG_BOD_TIME	Stream 1 Time and date of the last biochemical oxygen demand measurement	40314, 40315	
STREAM_1_RLOG_TPR_TIME	Stream 1 Time and date of the last total reactive and organic phosphorus measurement	40324, 40325	

Stream 2 measurement times

Name	Description	Register	Data type
STREAM_2_RLOG_TIC_TIME	Stream 2 Time and date of the last total inorganic carbon measurement	40328, 40329	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_2_RLOG_TOC_TIME	Stream 2 Time and date of the last total organic carbon measurement	40330, 40331	
STREAM_2_RLOG_TC_TIME	Stream 2 Time and date of the last total carbon measurement	40332, 40333	
STREAM_2_RLOG_VOC_TIME	Stream 2 Time and date of the last volatile organic carbon measurement	40334, 40335	
STREAM_2_RLOG_TN_TIME	Stream 2 Time and date of the last total nitrogen measurement	40336, 40337	
STREAM_2_RLOG_TP_TIME	Stream 2 Time and date of the last total phosphorus measurement	40338, 40339	
STREAM_2_RLOG_COD_TIME	Stream 2 Time and date of the last chemical oxygen demand measurement	40340, 40341	
STREAM_2_RLOG_BOD_TIME	Stream 2 Time and date of the last biochemical oxygen demand measurement	40342, 40343	
STREAM_2_RLOG_TPR_TIME	Stream 2 Time and date of the last total reactive and organic phosphorus measurement	40352, 40353	

Modbus register maps

Stream 3 measurement times

Name	Description	Register	Data type
STREAM_3_RLOG_TIC_TIME	Stream 3 Time and date of the last total inorganic carbon measurement	40356, 40357	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_3_RLOG_TOC_TIME	Stream 3 Time and date of the last total organic carbon measurement	40358, 40359	
STREAM_3_RLOG_TC_TIME	Stream 3 Time and date of the last total carbon measurement	40360, 40361	
STREAM_3_RLOG_VOC_TIME	Stream 3 Time and date of the last volatile organic carbon measurement	40362, 40363	
STREAM_3_RLOG_TN_TIME	Stream 3 Time and date of the last total nitrogen measurement	40364, 40365	
STREAM_3_RLOG_TP_TIME	Stream 3 Time and date of the last total phosphorus measurement	40366, 40367	
STREAM_3_RLOG_COD_TIME	Stream 3 Time and date of the last chemical oxygen demand measurement	40368, 40369	
STREAM_3_RLOG_BOD_TIME	Stream 3 Time and date of the last biochemical oxygen demand measurement	40370, 40371	
STREAM_3_RLOG_TPR_TIME	Stream 3 Time and date of the last total reactive and organic phosphorus measurement	40380, 40381	

Stream 4 measurement times

Name	Description	Register	Data type
STREAM_4_RLOG_TIC_TIME	Stream 4 Time and date of the last total inorganic carbon measurement	40384, 40385	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_4_RLOG_TOC_TIME	Stream 4 Time and date of the last total organic carbon measurement	40386, 40387	
STREAM_4_RLOG_TC_TIME	Stream 4 Time and date of the last total carbon measurement	40388, 40389	
STREAM_4_RLOG_VOC_TIME	Stream 4 Time and date of the last volatile organic carbon measurement	40390, 40391	
STREAM_4_RLOG_TN_TIME	Stream 4 Time and date of the last total nitrogen measurement	40392, 40393	
STREAM_4_RLOG_TP_TIME	Stream 4 Time and date of the last total phosphorus measurement	40394, 40395	
STREAM_4_RLOG_COD_TIME	Stream 4 Time and date of the last chemical oxygen demand measurement	40396, 40397	
STREAM_4_RLOG_BOD_TIME	Stream 4 Time and date of the last biochemical oxygen demand measurement	40398, 40399	
STREAM_4_RLOG_TPR_TIME	Stream 4 Time and date of the last total reactive and organic phosphorus measurement	40402, 40403	

Modbus register maps

Stream 5 measurement times

Name	Description	Register	Data type
STREAM_5_RLOG_TIC_TIME	Stream 5 Time and date of the last total inorganic carbon measurement	40406, 40407	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_5_RLOG_TOC_TIME	Stream 5 Time and date of the last total organic carbon measurement	40408, 40409	
STREAM_5_RLOG_TC_TIME	Stream 5 Time and date of the last total carbon measurement	40410, 40411	
STREAM_5_RLOG_VOC_TIME	Stream 5 Time and date of the last volatile organic carbon measurement	40412, 40413	
STREAM_5_RLOG_TN_TIME	Stream 5 Time and date of the last total nitrogen measurement	40414, 40415	
STREAM_5_RLOG_TP_TIME	Stream 5 Time and date of the last total phosphorus measurement	40416, 40417	
STREAM_5_RLOG_COD_TIME	Stream 5 Time and date of the last chemical oxygen demand measurement	40418, 40419	
STREAM_5_RLOG_BOD_TIME	Stream 5 Time and date of the last biochemical oxygen demand measurement	40420, 40421	
STREAM_5_RLOG_TPR_TIME	Stream 5 Time and date of the last total reactive and organic phosphorus measurement	40424, 40425	

Stream 6 measurement times

Name	Description	Register	Data type
STREAM_6_RLOG_TIC_TIME	Stream 6 Time and date of the last total inorganic carbon measurement	40428, 40429	integer, read only 0x00000000 to 0xFFFFFFFF
STREAM_6_RLOG_TOC_TIME	Stream 6 Time and date of the last total organic carbon measurement	40430, 40431	
STREAM_6_RLOG_TC_TIME	Stream 6 Time and date of the last total carbon measurement	40432, 40433	
STREAM_6_RLOG_VOC_TIME	Stream 6 Time and date of the last volatile organic carbon measurement	40434, 40435	
STREAM_6_RLOG_TN_TIME	Stream 6 Time and date of the last total nitrogen measurement	40436, 40437	
STREAM_6_RLOG_TP_TIME	Stream 6 Time and date of the last total phosphorus measurement	40438, 40439	
STREAM_6_RLOG_COD_TIME	Stream 6 Time and date of the last chemical oxygen demand measurement	40440, 40441	
STREAM_6_RLOG_BOD_TIME	Stream 6 Time and date of the last biochemical oxygen demand measurement	40442, 40443	
STREAM_6_RLOG_TPR_TIME	Stream 6 Time and date of the last total reactive and organic phosphorus measurement	40446, 40447	

3.3 Sample status registers

Name	Description	Register	Data type
RLOG_SMPL_STATUS	Sample status Quality of the sample, which is measured by the ultrasonic sensor	40200, 40201	float, read only 0.0 to 100.0
RLOG_SMPL_STATUS_TIME	Time and date of the last sample status measurement	40202, 40203	integer, read only 0x00000000 to 0xFFFFFFFF

Note: When a register is read, the value in the `_TIME` register for that register is updated.

3.4 Settings registers

Name	Description	Register	Data type	Min/Max
DEVICE_ADDR	DEVICE BUS ADDRESS setting	40500	integer, read/write	0x0000 to 0x00C8
DEVICE_ID	DEVICE ID setting	40501	integer, read/write	0x0000 to 0xFFFF
MANUF_ID	MANUFACTURE ID setting	40502	integer, read/write	0x0000 to 0x00FF

Modbus register maps

Name	Description	Register	Data type	Min/Max
DEVICE_SERIAL_ID	SERIAL NUMBER setting	40503, 40504, 40505	uint48, read only	0x000000000000 to 0xFFFFFFFFFFFF
PROTO_REV	Modbus protocol implementation revision rev AA.BB = 0xAABB	40506	integer, read only	0x0000 to 0x9999
FRMW_REV	FIRMWARE REV setting rev AA.BB = 0xAABB	40507	integer, read only	0x0000 to 0x9999
REGS_MAP_REV	REGISTERS MAP REV setting rev AA.BB = 0xAABB	40508	integer, read only	0x0000 to 0x9999
LOCATION_STR	LOCATION TAG setting <i>Note: Null terminate the string if there are less than 16 characters.</i>	40509, 40510, 40511, 40512, 40513, 40514, 40515, 40516	string, read/write	16 characters maximum
BAUDRATE	BAUDRATE setting 0 = 1200 bps 1 = 2400 bps 2 = 4800 bps 3 = 9600 bps 4 = 14400 bps 5 = 19200 bps 6 = 38400 bps 7 = 57600 bps 8 = 115200 bps	40517	integer, read/write	0x0000 to 0x0008
SYS_TIMEDATE ⁴	System time and date in seconds since January 1, 1970.	40518, 40519	integer, read/write	0x00000000 to 0xFFFFFFFF
SYS_TIME ⁴	System time in higher/lower bytes HH:MM = 0xHHMM	40520	integer, read/write	0x0000 to 0x3B3B
SYS_DATE ⁴	System date in 4 bytes Higher word DAY:MON = 0xDDMM Lower word YEAR = 0x0YYY	40521, 40522	integer, read/write	0x00000000 to 0x1F0C0833

⁴ This register cannot be changed until the system is fully stopped.

Name	Description	Register	Data type	Min/Max
REACT_TIC_RANGE1 ⁵	TIC range 1	40550, 40551	float, read only	0.0 to 1000000.0
REACT_TIC_RANGE2 ⁵	TIC range 2	40552, 40553		
REACT_TIC_RANGE3 ⁵	TIC range 3	40554, 40555		
REACT_TOC_RANGE1 ⁵	TOC range 1	40556, 40557		
REACT_TOC_RANGE2 ⁵	TOC range 2	40558, 40559		
REACT_TOC_RANGE3 ⁵	TOC range 3	40560, 40561		
REACT_TC_RANGE1 ⁵	TC range 1	40562, 40563		
REACT_TC_RANGE2 ⁵	TC range 2	40564, 40565		
REACT_TC_RANGE3 ⁵	TC range 3	40566, 40567		
REACT_TN_RANGE1 ⁵	TN range 1	40568, 40569		
REACT_TN_RANGE2 ⁵	TN range 2	40570, 40571		
REACT_TN_RANGE3 ⁵	TN range 3	40572, 40573		
REACT_TP_RANGE1 ⁵	TP range 1	40574, 40575		
REACT_TP_RANGE2 ⁵	TP range 2	40576, 40577		
REACT_TP_RANGE3 ⁵	TP range 3	40578, 40579		

3.5 Calibration registers

Name	Description	Register	Data type	Min/Max
AUTOCAL_PROG	Auto calibration day bit 0 = off bit 1 = Monday bit 2 = Tuesday bit 3 = Wednesday bit 4 = Thursday bit 5 = Friday bit 6 = Saturday bit 7 = Sunday	40700	integer, read only	0x0000 to 0x000F
AUTOCAL_PROG_TIME	Time of scheduled auto calibration in higher/lower bytes HH:MM = 0xHHMM	40701	integer, read only	0x0000 to 0x3B3B
CLOG_CAL_SELECT ⁶	Calibration type 0 = TIC 1 = TOC 2 = TC 3 = TN 4 = TP 5 = TPR	40702	integer, read/write	0x0000 to 0x0004

⁵ Shown as 0.0 if in the analysis mode for this result is not available.

⁶ This register value changes the values of the CLOG registers that follow.

Modbus register maps

Name	Description	Register	Data type	Min/Max
CLOG_CAL1_SPAN_STATUS	Status of the last span calibration bit 0 = calibration bit 1 = check bit 2 = calibration successful bit 3 = result outside band bit 4 = calculated from other range bit 5 = calculated from TOC/TC result bit 6 = entered by operator Note: If a calibration failure occurs on the master range, it is necessary to update the derived results status also.	40703	integer, read only	0x0000 to 0x007F
CLOG_CAL2_SPAN_STATUS		40717		
CLOG_CAL3_SPAN_STATUS		40731		
Note: The CLOG_CALx register values are only updated when the associated CLOG_CALx_SPAN_STATUS register is read.				
CLOG_CAL1_SPAN_TIME	Time and date of the last span calibration	40704, 40705	integer, read only	0x00000000 to 0xFFFFFFFF
CLOG_CAL2_SPAN_TIME		40718, 40719		
CLOG_CAL3_SPAN_TIME		40732, 40733		
CLOG_CAL1_SPAN_STD	Calibration standard Note: Null if bits 4–6 are set in the _STATUS register.	40706, 40707	float, read only	-1.0 ⁶ to 1.0 ⁶
CLOG_CAL2_SPAN_STD		40720, 40721		
CLOG_CAL3_SPAN_STD		40734, 40735		
CLOG_CAL1_SPAN_RSLT	Calibration results Note: Null if bits 4–6 are set in the _STATUS register.	40708, 40709	float, read only	-1.0 ⁶ to 1.0 ⁶
CLOG_CAL2_SPAN_RSLT		40722, 40723		
CLOG_CAL3_SPAN_RSLT		40736, 40737		
CLOG_CAL1_SPAN_FACTOR	Span adjustment factor	40710, 40711	float, read only	-1.0 ⁶ to 1.0 ⁶
CLOG_CAL2_SPAN_FACTOR		40724, 40725		
CLOG_CAL3_SPAN_FACTOR		40738, 40739		
CLOG_CAL1_ZERO_STATUS	Status of the last zero calibration bit 0 = zero calibration bit 1 = zero check bit 2 = zero successful bit 3 = result outside band bit 4 = calculated from other range bit 5 = TIC: no zero required bit 6 = entered by operator	40712	integer, read/write	0x0000 to 0x007F
CLOG_CAL2_ZERO_STATUS		40726		
CLOG_CAL3_ZERO_STATUS		40740		

Name	Description	Register	Data type	Min/Max
CLOG_CAL1_ZERO_TIME	Time and date of the last zero calibration	40713, 40714	integer, read only	0x00000000 to 0xFFFFFFFF
CLOG_CAL2_ZERO_TIME		40727, 40728		
CLOG_CAL3_ZERO_TIME		40741, 40742		
CLOG_CAL1_ZERO_OFFSET	Zero offset	40715, 40716	float, read only	-1.0 ⁶ to 1.0 ⁶
CLOG_CAL2_ZERO_OFFSET		40729, 40730		
CLOG_CAL3_ZERO_OFFSET		40743, 40744		

3.6 Diagnostics registers

Name	Description	Register	Data type	Min/Max
OXF_ANLS	Shows the oxidation analysis type bit 0 = TIC+TOC bit 1 = TC bit 2 = VOC bit 3 = TIC+TOCe bit 4 = TCe	40586	integer, read only	0x0000 to 0x07FF
LQP_ANLS	Shows the liquid analysis type bit 0 = TN bit 1 = TP bit 2 = TN+TP	40587	integer, read only	0x0000 to 0x0017
PANEL_TEMP	Temperature in the enclosure (°C)	40800, 40801	float, read only	-100.0 to 150.0
ATM_PRESS	Atmospheric pressure measurement from sensor (kPa)	40802, 40803	float, read only	0.0 to 250.0
CO2A_ZERO ⁷	CO ₂ analyzer zero setting	40804, 40805	float, read only	-1.0 ⁶ to 1.0 ⁶
COOLER_TEMP	Cooler temperature (°C), if measured	40806, 40807	float, read only	-100.0 to 150.0
TP_BOILER_TEMP	Temperature of the TP boiler (°C)	40808, 40809	float, read only	-100.0 to 150.0
TP_MIX_BOILER_TEMP	Temperature of the TP mixer boiler (°C)	40810, 40811	float, read only	-100.0 to 150.0

⁷ This register is set to 0.0 when power is set to on and is set to the correct value during the ANALYZER_ZERO reaction condition.

Modbus register maps

Name	Description	Register	Data type	Min/Max
REACT_STREAM_VALVE	Analysis reaction stream valve 0 = no analysis on any stream valve 1 = analysis on Stream 1 valve 2 = analysis on Stream 2 valve 3 = analysis on stream 3 valve 4 = analysis on Stream 4 valve 5 = analysis on Stream 5 valve 6 = analysis on Stream 6 valve	40816	integer, read only	0 to 6
REACT_RANGE	Analysis reaction range 0 = no analysis reaction 1 = analysis reaction range 1 2 = analysis reaction range 2 3 = analysis reaction range 3	40817	integer, read only	0 to 3
ACID_RGNT_STATUS	Number of days of acid remaining	40818	integer, read only	0 to 999
BASE_RGNT_STATUS	Number of days of base remaining	40819	integer, read only	0 to 999
TN_CLEAN_RGNT_STATUS	Number of days of TN cleaning fluid remaining	40820	integer, read only	0 to 999
DIW_RGNT_STATUS	Number of days of deionized water remaining	40821	integer, read only	0 to 999
C_RGNT_STATUS	Number of days of Reagent C remaining	40822	integer, read only	0 to 999
D_RGNT_STATUS	Number of days of Reagent D remaining	40823	integer, read only	0 to 999
REACT_CNTR	Reaction counter	40824, 40825	integer, read only	0x00000000 to 0xFFFFFFFF
SERVICE_REQ	Number of days until service is necessary	40826	integer, read only	0x0000 to 0xFFFF

3.7 Error, Warning and Notification registers

For descriptions of the fault codes, refer to *Troubleshooting* in the Maintenance and Troubleshooting Manual.

Name	Description	Register	Data type	Min/Max
SYS_ALARM_STATUS	Alarm status bit 0 = fault bit 1 = warning bit 2 = notification bit 3 = Drinking water warning	49930	integer, read only	0x0000 to 0x000F
SYS_COND_GRP	bit 0 = fault 01_LOW O2 FLOW - EX bit 1 = fault 02_LOW O2 FLOW - SO ... bit 15 = fault 16_SAMPLE VALVE SEN3	49950		
SYS_COND_GRP	bit 0 = fault 17_SMPL VALVE NOT SYNC bit 1 = fault 18_LIQUID LEAK DET ... bit 15 = fault 33_TOC SPAN CHCK FAIL	49951		
...		
SYS_COND_GRP	bit 0 = fault 241 bit 1 = fault 242 ... bit 15 = fault 257	49965		

3.8 Status and external control registers

Name	Description	Register	Data type	Min/Max
SYS_OP_STATUS	Operation status bit 0 = normal operation bit 1 = manual operation bit 2 = calibration bit 3 = zero bit 4 = remote standby is activated bit 5 = maintenance switch is activated	49931	integer, read only	0x0000 to 0x003F
SYS_REM_CTRL	System remote control 0 = no change 1 = system finish and stop 2 = analysis start 3 = zero cal start 4 = zero check start 5 = span cal start 6 = span check start 7 = reagents purge and zero	49932	integer, read/write	0 to 7
SYS_REM_CTRL_STANDBY	Set Remote Standby function 0 = Modbus remote standby deactivated 1 = Modbus remote standby activated Note: The content of this register is internally ORed (boolean logic) with the Remote Standby digital input, if available.	49933	integer, read/write	0 to 1

Modbus register maps

Name	Description	Register	Data type	Min/Max
SYS_REM_CTRL_SYNC	Synchronization output for remote control operation Note: This register is enabled even when no SYNC output is identified.	49934	integer, read only	0 to 1
SYS_REM_CTRL_RANGE	Select next range 0 = not selected / auto 1 = range 1 2 = range 2 3 = range 3 Note: If this register value is 0, the range is selected with the EXT_RANGE_MUX1-2 digital inputs, if available. If the EXT_RANGE_MUX1-2 digital inputs are not available, the value of this register controls the digital input lines.	49935	integer, read/write	0 to 3
SYS_REM_CTRL_STREAM	Next stream to be selected bit 0 = Stream 1 bit 1 = Stream 2 bit 2 = Stream 3 bit 3 = Stream 4 bit 4 = Stream 5 bit 5 = Stream 6 Note: The content of this register is internally ORed (boolean logic) with the STREAM SEL 1-6 digital inputs to enable or disable stream selection.	49936	integer, read/write	0x0000 to 0x007f
SYS_DEBUG_MODE	System debug mode register 0 = normal system operation 1 = system supplies pre-defined Modbus registers values	45000	integer, read/write	0x0000 to 0x0001

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