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BioTector B3500c/B3500s Online TOC Analyzer

Advanced Configuration

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Section 1 Advanced configuration	3
1.1 Safety information.....	3
1.2 Set the average result.....	3
1.3 Save 24-hour average results.....	3
1.4 Configure the pressure test and flow test settings.....	3
1.5 Configure the zero calibration settings.....	4
1.6 Configure the span calibration settings.....	6
1.7 Set the number of days between service.....	7
1.8 Enable automatic zero calibrations after service.....	7
1.9 Set automatic calibrations and/or checks.....	8
1.10 Show the calibration curves.....	9
1.11 Configure the fault settings.....	9
1.12 Configure the reaction check settings.....	11
1.13 Set to demonstration mode.....	12
1.14 Set the oxidation analysis mode.....	12
1.15 Configure System Program 1.....	13
1.16 Configure System Program 2.....	15
1.17 Configure System Program 3.....	16
1.18 Configure the reagent purge cycle.....	17
1.19 Configure the CO ₂ analyzer settings.....	18
1.20 Configure the cooler settings.....	18
1.21 Configure the ozone destructor.....	19
1.22 Hardware configuration.....	20
Section 2 4-20 mA output modes	21
2.1 Stream multiplex mode.....	21
2.2 Full multiplex mode.....	22
Section 3 Modbus register maps	25
3.1 Measurement registers.....	25
3.2 Measurement time registers.....	26
3.3 Sample status registers.....	27
3.4 Settings registers.....	27
3.5 Calibration registers.....	29
3.6 Diagnostics registers.....	30
3.7 Error, Warning and Notification registers.....	32
3.8 Status and external control registers.....	32

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. 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
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	<p>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: 0.100).</p> <p>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.</p>

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.

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 (6.0 L/h) for the number of consecutive reactions selected in the PRESSURE CHCK COUNT setting. PRESSURE CHCK FAULT setting cannot be changed.
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: 45 L/h).
REACTOR PURGE CHECK	Sets the time that the analyzer measures the oxygen gas flow during the two pressure releases that are done at the end of each analysis cycle (default: 4s). The reactor purge check identifies possible blockages or restrictions in the reactor and/or the sample out lines and valves.
REACTOR PURGE BAND	Sets the limit for a reactor purge warning. If the oxygen gas flow is not within the fault limit during the first pressure release at the end of each analysis cycle for three consecutive times, a 128_REACT PURGE WARN occurs (default: ± 3.0 L/h). If the oxygen gas flow is not within the fault limit during the second pressure release and an oxygen gas flow problem was identified during the first pressure release of the same reactor purge cycle, a 129_REACT PURGE FAIL occurs.

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, 3, 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 zero adjust value for the operation ranges that are set to 0.</i></p>
ZERO PROGRAM MAX	<p>Sets the maximum number of zero reactions done at a specific range if the average zero reading is not within the ZERO BAND setting (default: 10).</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>
ZERO BAND	<p>Sets the limit for the difference between the average zero value and each zero reaction value included in the average zero value (default: ± 0.040 mgC/L).</p> <p>If the difference between the average zero value and one or more of the zero reaction values is higher than the fault limit, the analyzer does another zero reaction until the difference is within the fault limit. If the difference is not within the fault limit after the maximum number of reactions (ZERO PROGRAM MAX), a 42_ZERO CAL FAIL or 43_ZERO CHCK FAIL warning occurs.</p> <p>When a 42_ZERO CAL FAIL warning occurs, the analyzer does not change the zero adjust values. The analyzer continues to use the previous zero adjust values.</p> <p>If the difference is within the fault limit after the maximum number of reactions, the analyzer completes the zero cycle and changes the zero adjust values.</p> <p>Note: <i>The ZERO BAND setting is used to do a stability check on the first programmed range. For example, if the zero calibration result (ZC) is set to range 0, 3, 0, the calculation is done for Range 2. Change the ZERO BAND setting if the ZERO PROGRAM settings are changed or the analyzer will not become stable and a 42_ZERO CAL FAIL warning will not occur.</i></p> <p>Note: <i>If the analyzer completes the zero cycle on the operation range (e.g., range 1), the analyzer does not do a zero cycle on the other ranges.</i></p>
ZERO WATER	<p>Sets the sample type. NO (default)—The analyzer uses no sample during zero calibrations or zero checks.</p> <p>YES—The analyzer uses deionized water during zero calibrations and zero checks. Supply the deionized water at the MANUAL fitting.</p>
PH ADJUST BASE	<p>Sets the number of base pump pulses the analyzer adds during analysis at each operation range (R1, R2 and R3). Default: 14, 14, 0</p>
PH ADJUST TIME	<p>Sets the mixing time of the reactor after the analyzer adds the base reagent (default: 60s).</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: 5).</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 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>
TOC CAL STD	<p>Note: In TC systems, TIC CAL STD is not available.</p>
TIC CAL STD	<p>Sets the concentrations of the TIC and TOC calibration standards for span calibrations (defaults: TIC = 0.0 mgC/L and TOC = 20.0 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 for TIC or TOC is 0 to 25 mgC/L, 50% of the full scale value is 12.5 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>
TC CAL STD	<p>Note: The TC CAL STD menu only shows in VOC systems.</p> <p>Shows the TC CAL STD value, which is the sum of the TIC CAL STD and TOC CAL STD.</p> <p>If the TOC CAL STD or TIC CAL STD setting is 0.0 mgC/L, the TC CAL STD is set to 0.0 mgC/L so that the analyzer does not change the span adjust value for TC. In addition, the warning set with the TC BAND setting does not occur.</p>

Option	Description
TIC CHECK STD	Sets the concentrations of the TIC and TOC calibration standards for span checks (defaults: TIC = 0 mgC/L and TOC = 20.0 mgC/L).
TOC CHECK STD	If the calibration standard selected is 0.0 mgC/L, the analyzer ignores the span check results. In addition, the warning set with the TIC BAND or TOC BAND settings do not occur.
TC CHEK STD	<i>Note: The TC CHEK STD menu only shows in VOC systems.</i> Shows the TC CHEK STD value, which is the sum of the TIC CHECK STD and TOC CHECK STD. If the TOC CHECK STD or TIC CHECK STD setting is 0.0 mgC/L, the TC CHEK STD is set to 0.0 mgC/L so that the analyzer ignores the span check results for TC. In addition, the warning set with the TC BAND setting does not occur.
TIC BAND TOC BAND	Sets the tolerance limits based on the last calibration (default: ± 25%) for the span calibration or span check results for TIC and TOC. 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.
TIC FACTOR = TOC	Sets the TIC span adjust value to the same value as the TOC span adjust value. When the TOC span adjust value is changed, the TIC span adjust value is also changed. (Default: Yes, enabled)

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>If the ZERO WATER setting in the SYSTEM CONFIGURATION menu is set to YES, make sure to plumb a 5 L container of deionized water to the MANUAL fitting before a zero calibration is started. The default setting for ZERO WATER is NO (no sample).</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.

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	<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

1.11 Configure the fault settings

Set the conditions when faults and warnings occur. Do not change these 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	<p>Sets the high CO₂ limit for zero calibrations and zero checks. A 52_HIGH CO2 IN BASE warning occurs if the CO₂ reading is higher than the BASE CO2 ALARM setting (default: 250ppm).</p> <p>When a 52_HIGH CO2 IN BASE warning occurs, the analyzer sets the zero adjust values at the end of a successfully completed zero calibration.</p>
CO2 ZERO LINE	<p>Sets the CO₂ zero value for the analyzer zero step (default: 0 ppm). AUTO (default)—The analyzer sets the CO2 ZERO LINE value during the analyzer zero step. M (manual)—The CO2 ZERO LINE setting is used.</p> <p>For example, if there is a CO₂ leak into the source or detector sections of the CO₂ analyzer, a 400 ppm CO₂ level in the environment will increase the CO2 ZERO LINE level to approximately 250 ppm within 24 days of online operation or after approximately 5000 reactions.</p>

Option	Description
CO2 ZERO ALARM	<p>Sets the CO₂ alarm limit for the analyzer zero step (default: 250 ppm). A 12_HIGH CO2 IN O2 fault occurs if the CO₂ measured at the analyzer zero step for the oxygen gas input is more than the CO2 ZERO LINE setting plus the CO2 ZERO ALARM setting for three consecutive reactions.</p> <p>The CO₂ zero alarm limit identifies an oxygen concentrator failure. If the oxygen concentrator has a failure, the oxygen purity will decrease and CO₂ 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.</p>
SERVICE COUNTER	<p>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.</p> <p>SERVICE COUNTER is set for normal site conditions. It may be necessary to adjust the service interval based on the site conditions.</p> <p>Note: Changes to the SERVICE COUNTER setting will change the MAINTENANCE > DIAGNOSTICS > SERVICE > SERVICE REQUIRED IN setting.</p>
OZONE TEST TIME	<p>Sets the time limit for the ozone test to pass (default: 18s).</p> <p>Note: The maximum time the ozone generator is on during an ozone test is 60 seconds.</p>
OZONE GEN ALARM	<p>Sets the alarm limit for the current through the ozone generator. A 102_OZONE GEN FAULT occurs if the current through the ozone generator is less than the alarm limit (default: 0.50A) for more than the specified time (default: 5s).</p>
OZONE GEN FAN ALARM	<p>Sets the alarm limit for the voltage band on the ozone generator fan. A 103_OZONE FAN FAULT occurs if the voltage on the ozone generator fan is less than 2.5V minus the voltage band (default: 0.00V) for more than the specified time (default: 5s) or is more than 2.5 V plus the voltage band for the specified time.</p> <p>To set the alarm to off, set OZONE GEN FAN ALARM to 0.00V.</p>
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>
ARCHIVE	<p>Enables the 116/117/118_LOW/NO SAMPLE 1/2/3 notifications to occur when there is no or low sample liquid from the sample stream. Default: NO</p>
AUTO RESET	<p>Note: AUTO RESET menu that follows ARCHIVE only shows when ARCHIVE is set to YES.</p> <p>Sets the 116/117/118_LOW/NO SAMPLE 1/2/3 notification to NO (default) or YES.</p> <p>NO—The analyzer automatically acknowledges the notification. YES— The user manually acknowledges the notification.</p>
SAMPLE FAULT 1 to 3	<p>Sets a time delay for the SAMPLE FAULT 1/2/3 relay and the 122/123/124_SAMPLE FAULT 1/2/3 notification (default: 100s). The time delay stops a sample fault that occurs for a short time from setting the SAMPLE FAULT 1/2/3 relay to on.</p>

Option	Description
AUTO RESET	<p>Note: <i>AUTO RESET</i> menu that follows <i>SAMPLE FAULT 1 to 3</i> only shows when <i>SAMPLE FAULT 1 to 3</i> is set to <i>YES</i>.</p> <p>Sets the 122/123/124_ <i>SAMPLE FAULT 1/2/3</i> notification to be automatically acknowledged (<i>YES</i>) or to be acknowledged manually (<i>NO</i>, default).</p>
COOLER ALARM	<p>Sets the alarm limit for the current through the cooler. A 107_ <i>COOLER ALARM</i> occurs if the current through the cooler is less than the alarm limit (default: 0.10A) for more than the specified time (default: 5s). To set the alarm to off, set <i>COOLER ALARM</i> to 0.00A.</p>
COOLER FAN ALARM	<p>Sets the alarm limit for the voltage band on the cooler fan. A 108_ <i>COOLER FAN ALARM</i> occurs if the voltage on the cooler fan is less than 2.5V minus the voltage band (default: 1.00V) for more than the specified time (default: 5s) or is more than 2.5V plus the voltage band for the specified time. To set the alarm to off, set <i>OZONE GEN FAN ALARM</i> to 0.00V.</p>
SIGMATAX FLT DELAY	<p>Note: <i>SIGMATAX FLT DELAY</i> only shows on <i>B3500s</i> analyzers configured to operate with the <i>Sigmatax Sampler</i>.</p> <p>Sets the time interval during which the <i>B3500s</i> analyzer ignores problems with the "sample ready" signal from the sampler (default: 900s).</p> <p>A 130_ <i>NO SIGMATAX SIGNAL</i> fault occurs and the analyzer stops when there is a problem with the "sample ready" signals from the sampler. For example, when the IR signal sent from the sampler is low for more than the <i>SIGMATAX FLT DELAY</i> time or when the IR signal is high for more than 3600 seconds.</p> <p>A 131_ <i>SIGMATAX FAULT</i> occurs and the analyzer stops when the sampler sends an error signal for more than 60 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 <i>CO2 LEVEL</i> setting to 60% of the average CO₂ peak reading from the last zero calibration or zero check. MAN—The analyzer uses the <i>CO2 LEVEL</i> 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 <i>CO2 LEVEL</i> setting for the number of reactions in the <i>REACTION COUNT</i> setting, a 04_ <i>NO REACTION</i> warning or a 04_ <i>NO REACTION</i> fault occurs.</p> <p>Note: <i>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.</i></p>
FAULT TYPE	<p>Set the fault type of the 04_ <i>NO REACTION</i> alarm. Options: <i>FAULT</i> or <i>WARNING</i> (default).</p>

Option	Description
REACTION COUNT	Sets the number of reactions for the 04_NO REACTION alarm (default: 3).
TIC CHECK	Sets the CO ₂ check limit in the TIC analysis (default: 7 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: 25 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.
TC CHECK	In VOC systems, sets the CO ₂ check limit in the TC analysis (default: 25 ppm). If the CO ₂ level is more than the TC CHECK setting at the end of the TC oxidation step, the analyzer increases the TC SPARGE TIME and TC OXIDATION time for 1 second, then identifies the CO ₂ reading again. If the CO ₂ is not less than the TC CHECK value after 300 seconds, a 91_TC 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 Configure System Program 1

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

1. Select MAINTENANCE > SYSTEM CONFIGURATION > SYSTEM PROGRAM > SYSTEM PROGRAM 1.
2. Select an option.
 - **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 SYSTEM 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.
ANALYSER 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. <i>Note: At the analyzer zero step, a 12_HIGH CO2 IN O2 fault occurs if the CO₂ analyzer reading is more than the CO2 ZERO LINE plus the CO2 ZERO ALARM value (default: 250 ppm) for three consecutive reactions.</i>
TIC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TIC sparge step for operation range 1 (default: 6p).
SAMPLE LINE FILL	Sets the number of pulses the sample pump operates forward to fill the sample tubing between the sample (out) valve and the reactor valve (default: 4p).
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 1 (default: 25p). One pulse is ½ revolution of the pump roller. P-V (pinch valve)—The type of sample valve used for injection. <i>Note: Calibrate the analyzer after the SAMPLE IN setting is changed.</i>
DELAY	Sets the time and flow rate for the carrier gas operation. The carrier gas adds the reagents to the mixer reactor (default: 1s, 1 L/h).
SAMPLE PORT PURGE	Sets the time the sample pump operates in reverse after the sample injection to discharge the sample liquid in the tubing between the reactor valve and T fitting (default: 0.2s).

Advanced configuration

Table 1 SYSTEM PROGRAM 1—TIC+TOC settings (continued)

Option	Description
TIC SPARGE TIME	<p>Sets the TIC sparge time (default: 36s) and oxygen flow (default: 20 L/h). The analyzer sparges and measures the TIC content of the sample during the TIC sparge time.</p> <p>If the TIC level is not less than the TIC CHECK level (default: 10 ppm CO₂) before the end of the TIC SPARGE TIME, the analyzer increases the time (extension time) until the TIC level is less than the 10 ppm level.</p> <p>Note: A 50_TIC OVERFLOW warning occurs if the TIC level is not less than 10 ppm before the end of the maximum extension time (300s). The maximum extension time cannot be changed.</p>
BASE	<p>Sets the quantity of base reagent (pulses) added to the reactor for operation range 1 (default: 34p).</p>
BASE OXIDATION	<p>Sets the base oxidation time (default: 90s) and the oxygen flow (default: 10 L/h). The analyzer oxidizes the sample during the base oxidation time.</p> <p>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 PEAK INTEGRATION is TOC+BASE OXID in the RESULT INTEGRATION menu.</p>
TOC ACID	<p>Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 1 (default: 28p).</p>
TOC SPARGE TIME	<p>Sets the TOC sparge time (default: 75s) and oxygen flow (default: 20 L/h). The analyzer sparges and measures the TOC content of the sample during the TOC sparge time.</p> <p>If the TOC level is not less than the TOC CHECK level (default: 25 ppm CO₂) before the end of the TOC SPARGE TIME, the analyzer increases the time (extension time) until the TOC level is less than the 25 ppm level.</p> <p>Note: A 51_TOC OVERFLOW warning occurs if the TOC level is not less than 25 ppm before the end of the maximum extension time (default: 300s). The maximum extension time cannot be changed.</p>
TOC OXIDATION	<p>Sets the time the ozone generator operates at the start of the TOC sparge step (default: 25s).</p> <p>Note: The TOC oxidation time is part of the TOC sparge step and does not increase the TOC sparge time.</p>
REACTOR PURGE	<p>Set the reactor purge time (default: 55s). The analyzer removes the contents of the reactor during the reactor purge time.</p> <p>During the REACTOR PURGE phase, the system continuously monitors the oxygen gas flow with the mass flow controller (MFC). If a gas leak or a flow problem is sensed, a 06_PRESSURE CHCK FAIL or a 02_LOW O2 FLOW - SO system fault occurs.</p>
PRESSURE CHECK	<p>Sets the time and oxygen gas flow at which the mixer reactor is pressurized for the REACTOR PURGE phase (default: 30 second at 40 L/h).</p>
PRESSURE RELEASE	<p>Sets the time the analyzer opens the reactor valve (MV3) to release the pressure in the reactor when the gas flow is equal to or less than the PRESSURE CHCK FAULT level for more than 1 second during the PRESSURE CHECK phase (default: 20s at 45 L/h oxygen flow). Most of the liquid in the mixer reactor is removed through the sample out port.</p> <p>Note: The PRESSURE CHCK FAULT level is set on the PRESSURE/FLOW TEST menu (default: 6.0 L/h).</p>
PRESSURE PURGE	<p>Sets the time the mixer reactor is pressurized after the PRESSURE RELEASE phase is completed (default: 7s at 60 L/h oxygen flow).</p>
PRESSURE RELEASE	<p>Sets the time the analyzer opens the reactor valve (MV3) to release the pressure in the reactor after the PRESSURE PURGE phase is completed (default: 10s at 45 L/h oxygen flow).</p> <p>Note: Unlike the first PRESSURE RELEASE phase, the motor of the mixer reactor is on during the second PRESSURE RELEASE phase. The remaining liquid in the mixer reactor is removed through the sample out port.</p>
CYCLES	<p>Sets the number of times the PRESSURE PURGE and the PRESSURE RELEASE phases occur during the REACTOR PURGE phase (default: 0).</p>
ANALYSER PURGE	<p>Sets the analyzer purge time (default: 30s) and oxygen flow (default: 40L/h). The analyzer removes the contents of the CO₂ analyzer during the analyzer purge time.</p>
IDLE O2 FLOW	<p>Sets the oxygen flow when the analyzer is in remote standby or is stopped (default: 1 L/h). The IDLE O2 FLOW setting supplies a small flow of oxygen through the system when the analyzer stopped to prevent damage to the oxygen pressure regulator.</p>
REACTION TIME	<p>Shows the total reaction time for operation range 1.</p>

Table 2 SYSTEM 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.
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>
TC SPARGE TIME	Sets the TC sparge time (default: 50s) and oxygen flow (default: 20 L/h). The analyzer sparges and measures the TC content of the sample during the TC sparge time. If the TC level is not less than the TC CHECK level (default: 25 ppm CO ₂) before the end of the TC SPARGE TIME, the analyzer increases the time (extension time) until the TC level is less than the 25 ppm level. <i>Note: A 91_TC OVERFLOW warning occurs if the TC level is not less than 25 ppm before the end of the maximum extension time (default: 300s). The maximum extension time cannot be changed.</i>
TC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TC sparge step for operation range 1 (default: 28p).
TC OXIDATION	Sets the time the ozone generator operates at the start of the TC Sparge phase (default: 25s). The TC OXIDATION time is part of the TC Sparge phase and does not increase the TC SPARGE TIME.

Table 3 SYSTEM PROGRAM 1—VOC settings

Option	Description
SAMPLE PUMP FORWARD 2	Sets the time the sample pump operates forward to fill the sample tubing with sample before the second sample injection is added to the mixer reactor for the TIC+TOC analysis reaction (default: 3s).

1.16 Configure System Program 2

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

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

Table 4 SYSTEM PROGRAM 2—TIC+TOC settings

Option	Description
RANGE CHANGE 1–2	Sets the concentration levels the analyzer uses to change the operation range automatically from operation range 1 to operation range 2 (default: 26.0 mgC/L). <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 (default: 1000.0 mgC/L). <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 (default: 21.0 mgC/L). <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>

Advanced configuration

Table 4 SYSTEM PROGRAM 2—TIC+TOC settings (continued)

Option	Description
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 2 (default: 12p). One pulse is ½ revolution of the pump roller. P-V (pinch valve)—The type of sample valve used for injection. <i>Note: Calibrate 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: 8p).
BASE	Sets the quantity of base reagent (pulses) added to the reactor for operation range 2 (default: 40p).
BASE OXIDATION	Sets the base oxidation time (default: 150s). The analyzer oxidizes the sample during the base oxidation time for operation range 2. <i>Note: If the base oxidation time for operation range 2 is different than the base oxidation time for operation range 1, depending on the difference, the reaction time at operation range 2 is longer or shorter than the reaction time shown on the SYSTEM PROGRAM 1 menu.</i>
TOC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 2 (default: 32p).

Table 5 SYSTEM PROGRAM 2—TC settings

Option	Description
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 2 (default: 5p). P-V (pinch valve)—The type of sample valve used for injection. <i>Note: Calibration the analyzer after the SAMPLE IN setting is changed.</i>

1.17 Configure System Program 3

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

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

Table 6 SYSTEM PROGRAM 3—TIC+TOC settings

Option	Description
RANGE CHANGE 2–3	Sets the concentration levels the analyzer uses to change the operation range automatically from operation range 2 to operation range 3 (default: 1000.0 mgC/L). <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 the analyzer uses to change the operation range automatically from operation range 3 to operation range 2 (default: 1000.0 mgC/L). <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 (default: 1000.0 mgC/L). <i>Note: Refer to the SYSTEM RANGE DATA screen to see the three operation ranges. Select OPERATION > SYSTEM RANGE DATA.</i>

Table 6 SYSTEM PROGRAM 3—TIC+TOC settings (continued)

Option	Description
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 3 (default: 5p). One pulse is ½ revolution of the pump roller. P-V (pinch valve)—The type of sample valve used for injection. <i>Note: Calibrate 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: 12p).
BASE	Sets the quantity of base reagent (pulses) added to the reactor for operation range 3 (default: 70p).
BASE OXIDATION	Sets the base oxidation time (default: 150s). The analyzer oxidizes the sample during the base oxidation time for operation range 3. <i>Note: If the base oxidation time for operation range 3 is different than the base oxidation time for operation range 1, depending on the difference, the reaction time at operation range 3 is longer or shorter than the reaction time shown on the SYSTEM PROGRAM 1 menu.</i>
TOC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TOC sparge step for operation range 3 (default: 58p).

Table 7 SYSTEM PROGRAM 3—TC settings

Option	Description
SAMPLE IN	Sets the quantity of sample (pulses) added to the reactor for operation range 3 (default: 5p). P-V (pinch valve)—The type of sample valve used for injection. <i>Note: Calibration the analyzer after the SAMPLE IN setting is changed.</i>
TC ACID	Sets the quantity of acid reagent (pulses) added to the reactor for the TC sparge step for operation range 3 (default: 58p).

1.18 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 PURGE	Sets the total operation time of the acid and base pumps to prime the reagents during the INSTALL NEW REAGENTS cycle (default: 39s).
BASE PURGE	Sets the number of times the reagent priming and reactor purge operation are done (default: 4).
REACTOR ACID FILL	Set the quantity of acid reagent added to the reactor at the end of the ACID PURGE cycle (default: 300p).
REACTOR BASE FILL	Set the quantity of base reagent added to the reactor at the end of the BASE PURGE cycle (default: 450p).
REACTOR WASH TIME	Sets the time the acid and base reagents are mixed in the reactor during the REACTOR WASH TIME to balance the reactor pH and make the reactor pH neutral (default: 100s).

1.19 Configure the CO₂ analyzer settings

Set the full scale on the analysis graph. Set the 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: 5000 ppm).
BAUDRATE	Sets the data communication signaling speed of the CO ₂ analyzer with the RS232 communication interface (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.

1.20 Configure the cooler settings

Set the cooler setpoint temperature and operation mode.

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

Option	Description
MODE	Sets the operation mode of the cooler. T CTRL (temperature control) (default)—T DIFFERENCE setting sets the cooler temperature. PWM (pulse width modulation)—PWM DUTY setting sets the cooler to backup operation mode.
PWM DUTY	Sets the operation mode of the cooler in backup mode (e.g., when a 107_COOLER FAULT, 108_COOLER FAN FAULT or 113_TEMP SENSOR FAULT warning occurs). In backup mode, the cooler is on for 10% (default) of the time and off the remaining time.
50% PWM OFFSET	Sets the midpoint offset for the calibration curve of the cooler temperature (default: 14.0C), which is linear. When the cooler operates with pulse width modulation at 50%, the cooler temperature is usually approximately 14 °C below ambient temperature.

Option	Description
50% PWM SLOPE	Sets the slope for the calibration curve of the cooler temperature at midpoint (default: 5.00%/°C). When the cooler operates with pulse width modulation at 50%, the cooler temperature changes by approximately 1 °C with each 5% change in pulse width modulation.
T DIFFERENCE	<p>Sets the temperature difference between the analyzer temperature and the cooler temperature (default: 16 °C). The analyzer temperature sensor is on the Oxygen (O₂) Controller Board.</p> <p>The cooler setpoint is the ambient temperature, which is the analyzer temperature, minus the T DIFFERENCE setting. For example, if the analyzer temperature is 20 °C, the cooler setpoint is 4 °C when the T DIFFERENCE setting is 16 °C.</p> <p>Note: If the cooler temperature will decrease to below 5 °C, the analyzer decreases the pulse width modulation so the temperature of the cooler does not decrease to below 5°C, which prevents the condensate water in the cooler from freezing.</p>

1.21 Configure the ozone destructor

Set the operation mode for the ozone destructor heater.

1. Select MAINTENANCE > SYSTEM CONFIGURATION > OZONE DESTROY PROGRAM.
2. Select an option.

Option	Description
PWM DUTY	<p>Sets the standard operation of the ozone destructor heater. When PWM DUTY is set to 50% (default), the ozone destructor heater is on 50% of the time, which is usually 5 seconds on and 5 seconds off.</p> <p>Note: When the analyzer temperature is higher than 40 °C for more than 2 minutes, the analyzer sets PWM DUTY to 10%. When PWM DUTY is set to 10%, the ozone destructor heater is on 10% of the time, which is usually 1 second on and 9 seconds off.</p> <p>Note: When the analyzer temperature is below 15 °C for more than 2 minutes, the analyzer sets PWM DUTY to 100%. When PWM DUTY is set to 100%, the ozone destructor heater is on all of the time. No warnings occur when the analyzer changes the PWM DUTY setting.</p>
PURGE CYCLE MODE	<p>AUTO (default)—The ozone destructor heater and the cooler are controlled by the PURGE CYCLE FLOW and AUTO PURGE CYCLE settings.</p> <p>OFF—The ozone destructor heater and the cooler operate normally.</p> <p>MAN—The ozone destructor heater and the cooler are controlled by the MAN PURGE CYCLE setting.</p>
PURGE CYCLE FLOW	<p>Note: The PURGE CYCLE FLOW setting is only available when PURGE CYCLE MODE is set to AUTO.</p> <p>Sets a limit for the flow test (default: 48 L/h). When the flow measured during the flow test is less than the PURGE CYCLE FLOW setting, the ozone destructor heater and the cooler are controlled by the AUTO PURGE CYCLE setting.</p>

Option	Description
AUTO PURGE CYCLE	<p>Note: The <i>AUTO PURGE CYCLE</i> setting is only available when <i>PURGE CYCLE MODE</i> is set to <i>AUTO</i>.</p> <p>The first setting is the number of analysis cycles the ozone destructor heater is set to off (default: 15). The second setting is the number of analysis cycles the ozone destructor heater and the cooler are set to off (default: 15).</p> <p>The analyzer uses the <i>AUTO PURGE CYCLE</i> settings one time after the flow test is done.</p>
MAN PURGE CYCLE	<p>Note: The <i>MAN PURGE CYCLE</i> setting is only available when <i>PURGE CYCLE MODE</i> is set to <i>MAN</i>.</p> <p>The first setting is the number of analysis cycles the ozone destructor and the cooler operate as normal (default: 2000). The second parameter is the number of analysis cycles the ozone destructor heater is set to off (default: 15). The third setting is the number of analysis cycles the ozone destructor heater and cooler are set to off (default: 15).</p>

1.22 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 modes that follow:

- **DIRECT** (direct mode)—Each channel (4-20 mA output) shows a specified stream (STREAM 1) and result type (e.g., TOC).
- **BASIC**—The 4–20 mA outputs (Channels 1–4) that are set to show STREAM 1 also show the zero and span calibration/check results.
- **STREAM MUX** (stream multiplex mode)—Channel 1 identifies the stream (e.g., STREAM 1). Channels 2 to 4 are configured to show one result type each (e.g., TOC). Channels 2 to 4 show the results for the streams in the OUTPUT 1 to 4 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 4 settings. Channel 4 shows the 24-average results for the streams and result types in the OUTPUT 1 to 4 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 4 (4–20 mA Outputs 2 to 4) 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 4 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 4 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 to 4. Configure one relay to be a 4-20mA READ relay, refer to *Configure the relays* in the Installation and Operation Manual.

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).

4-20 mA output modes

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

Table 8 Channel 1 signals

Stream	Output	Stream	Output
Change level	4 mA	Reserved	13 mA
STREAM 1	5 mA	Reserved	14 mA
STREAM 2	6 mA	Reserved	15 mA
STREAM 3	7 mA	Reserved	16 mA
Reserved	8 mA	CAL	17 mA
Reserved	9 mA	CAL Z	18 mA
Reserved	10 mA	CAL S	19 mA
MANUAL 1	11 mA	Reserved	20 mA
Reserved	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 22.

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.

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).

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 to 4. 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	BOD	10 mA
TIC	5 mA	Reserved	11 mA
TOC	6 mA	Reserved	12 mA
TC	7 mA	Reserved	13 mA
VOC	8 mA	Reserved	14 mA
COD	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_COD	Stream 1: Last chemical oxygen demand measurement	40013, 40014	
STREAM_1_RLOG_BOD	Stream 1: Last biochemical oxygen demand measurement	40015, 40016	

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_COD	Stream 2: Last chemical oxygen demand measurement	40041, 40042	
STREAM_2_RLOG_BOD	Stream 2: Last biochemical oxygen demand measurement	40043, 40044	

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 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_COD	Stream 3: Last chemical oxygen demand measurement	40069, 40070	
STREAM_3_RLOG_BOD	Stream 3: Last biochemical oxygen demand measurement	40071, 40072	

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_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 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_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 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_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	

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
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

Modbus register maps

Name	Description	Register	Data type	Min/Max
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
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		

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

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

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	40702	integer, read/write	0x0000 to 0x0004
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		

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_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		
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
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

Name	Description	Register	Data type	Min/Max
CO2A_ZERO ⁷	CO ₂ analyzer zero setting	40804, 40805	float, read only	-1.0 ⁶ to 1.0 ⁶
GCTRL_AIR_PRESSURE	Air pressure measured at the gas controller circuit board (kPa)	40812, 40813	float, read only	0.0 to 250.0
GCTRL_O2_PRESS	Oxygen pressure measured at the gas controller circuit board (kPa)	40814, 40815	float, read only	0.0 to 250.0
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
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

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.

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

Name	Description	Register	Data type	Min/Max
SYS_REM_CTRL_SYNC	Synchronization output for remote control operation <i>Note: This register is enabled even when no SYNC output is identified.</i>	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 <i>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.</i>	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 <i>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.</i>	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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