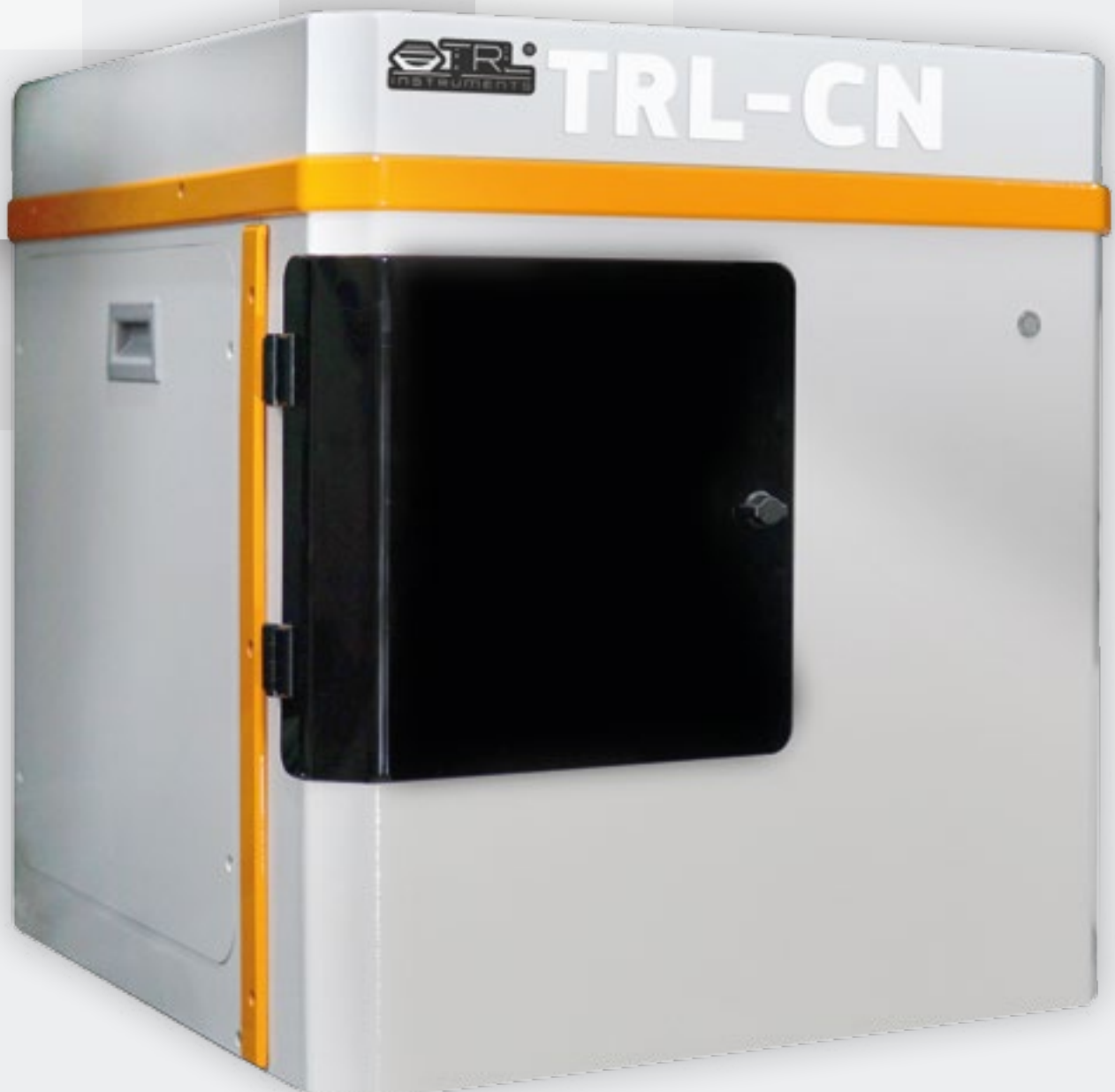




CARBON AND NITROGEN ANALYZERS

C-Series



Features of Carbon and Nitrogen Analyzers

Unique, Patented Two Zone Furnace Design

Having two adjustable furnace zones, by our patented two-zone furnace design help achieving low detection limits while allowing covering wide concentration ranges for carbon and nitrogen determination. The reactor design eliminates direct physical contact of the catalyst with samples, reducing sulfur and halogen poisoning thereby increasing catalyst service life. The design allows for large sample sizes up to 7 grams, making it possible to have representative measurements with less lab work.



Simultaneous Carbon and Nitrogen Analysis

High temperature catalytic oxidation (HTCO) technology and the in-house developed catalyst allow simultaneous measurement of TC and TNb parameters in solid and liquid samples. The same catalyst serves for combustion of compounds containing carbon and nitrogen.



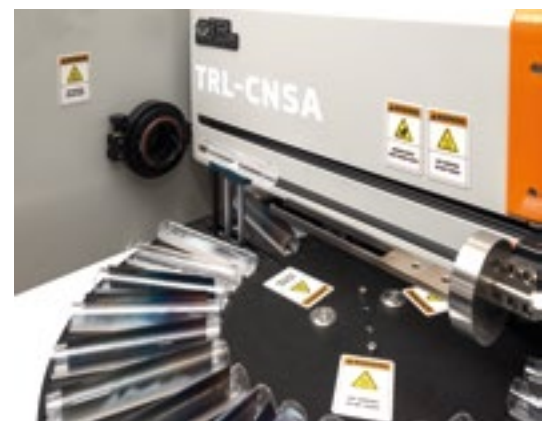
Ease of Maintenance

Design of carbon/nitrogen analyzers simplifies daily routine operations and maintenance. Maintenance and adjustment requirements are collected in a panel for easy access to each component.

Automated Sample Loading for Every Specific Analyzer

Two basic models of autosamplers are offered along with our carbon/nitrogen analyzers: one for solid sample automation(SSA) and the other for liquid sample automation(LSA). While using the LSA unit, the sample is pulled from a sample vial or flask via a syringe pump and injected into the reactor or another process unit depending on the analysis method.

SSA units are the universal sample automation units accepting sample loading into quartz sample cups, either liquid or solid. When high accuracy and lower detection limits are required, an LSA unit is recommended for liquid sample handling.



High and Low Mode Operations

Thanks to our dual mode (HIGH MODE and LOW MODE) technology. The user can cover a concentration range from zero to 100% carbon.

Low Cost of Operation

Long catalyst service life up to 2000 runs lowered and cost per analysis are advantageous features of TRL Instruments carbon/nitrogen analyzers.

User Friendly Software Functions

Laboratory manager can create hierarchy of users and distribution of authorities. All events are logged and permanently saved. User, sample, method, calibration, task, sequence and report definitions are entered through user friendly graphical user interface. Calibration Files can be created by choosing calibration run results.

Analyzers for All Applications

TRL Instruments offers carbon and nitrogen analyzers for the analysis of a variety of sample types including solids, liquids, sludges etc. Some of the parameters that can be determined are:

- Total Carbon (TC)
- Total Inorganic Carbon (TIC)
- Total Organic Carbon (TOC)
- Non-Purgeable Organic Carbon (NPOC)
- Dissolved Organic Carbon (DOC)
- Surface Carbon (SC)
- Residual Organic Carbon (ROC)
- Elemental Carbon (EC)
- Total Nitrogen (TN)

Here are some applications that TRL Instruments C/N Analyzers are typically being used for:

TOC in Solid Samples

TRL-TOC-S configuration with optional autosampler TRL-SSA with 30 sample positions for TC analysis. Samples can be pre-prepared manually for direct TOC measurement or manual IC analysis can be performed for subtraction from TC ($TC-IC=TOC$). Thanks to the HIGH MODE and LOW MODE dual range technology incorporated, the user has the opportunity to cover a concentration range of ppb to 100% carbon. Liquid samples can also be analyzed with the TRL-TOC-S by manual injection of samples in the solid sample boats. Field upgradable TN option is available.



TOC in Liquid Samples

TRL-TOG-L configuration is offered for liquid-only applications. Either the standard single sample configuration or the optional autosampler TRL-LSA with 46/63 sample positions can be chosen. TC, IC, TOC as NPOC, TOC as (TC-IC) parameters can be determined. Field upgradable TN option is also available.

Surface Carbon (SC) on Rolled Metal Sheets, Foils or Rods

The SC parameter is used as an indicator of oil remains on metal surfaces following rolling processes and can be measured by the TRL-SC with built-in autosampler TRL-SCSA with 30 sample positions. Automated sequence runs at isothermal conditions are adjustable between 400-1000°C.



Residual Organic Carbon (ROC) and Elemental Carbon (EC) in Solid Waste and Biomass

The TRL-ROC with built in autosampler TRL-ROCSA and temperature ramping capability complies with DN 19539 and can measure all three parameters in a single run.

Carbon and Nitrogen in Organic and Mineral Samples:

The macro TRL-CN analyzer can handle large sample sizes, up to 7 grams. The macro-scale analyzer TRL-CN provides the solution where larger sample sizes up to 7 grams are needed. Low level detection down to 1 ppm can be achieved for both carbon and nitrogen. This configuration is most suitable when speciation of carbon is not of interest. Built-in autosampler TRL-CNSA allows for unattended multi sample sequence runs. Maintenance requirements are reduced as no ash remains in the reactor. Thanks to the HIGH MODE and LOW MODE dual range, low level detection down to 1 ppm can also be achieved. This configuration is most suitable when speciation of carbon is not of interest. Built-in autosampler TRL-CNSA allows unattended multi sample runs. Maintenance requirements are reduced as no ash remains in the reactor.



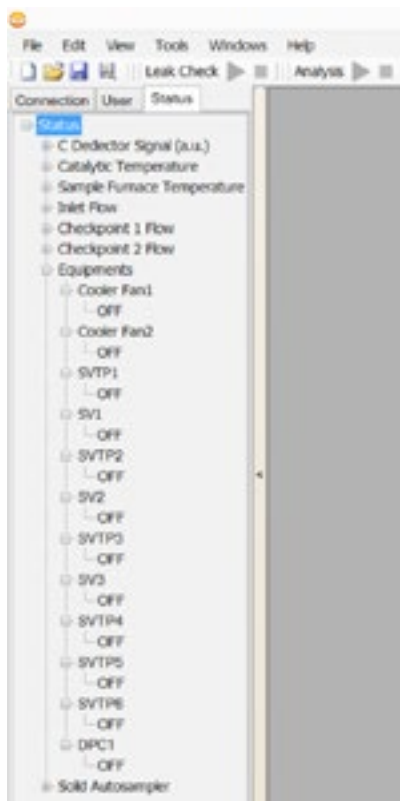
User Friendly Software Functions

Various user levels and authorities are defined

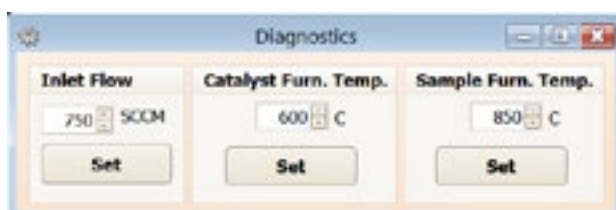


Login screen

Besides the controls during a run, manual diagnostics allow checking functionality of system components



Status panel



Diagnostics screen

User, sample, method, calibration, task, sequence and report definitions are entered through user friendly software screens.



Example of Sequence development screen for Solid Sample Autosampler



Example of sequence development screen for Liquid Sample Autosampler with 46 vial positions



Example of Sample Analysis Result



Example of Analysis Report

Calibration Files can be created by choosing calibration run results.



Example of Calibration File Description

Accessories

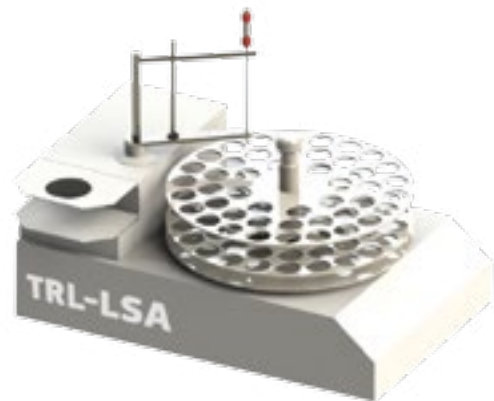
Solid Sample Autosampler

Model	TRL-SSA
Number of Sample Boats	30 positions
Power	500 VA, 100-240 V AC
Dimensions	HxWxD= 83 x 67 x 60 cm



Liquid Sample Autosampler

Model	TRL-LSA1
Number of Vials	46 sample capacity
Power	100 VA, 230 V AC
Dimensions	HxWxD= 36 x 27 x 44 cm



Model	TRL-LSA2
Number of Vials	21, 42 or 63 sample capacity
Power	450 VA, 100-240 V AC
Dimensions	HxWxD= 42 x 44 x 39 cm



Nitrogen Analyzer Unit

Model	TRL-TN
Measurement Method	High Temperature Catalytic Oxidation/ Chemiluminescence detection (CLD)
Ozone Source	100 mL/min High purity oxygen or 500 mL/min air. Supply pressure: 2 barg
Power	500 VA, 100-240 V AC
Dimensions	HxWxD= 42 x 51 x 21 cm



Application Areas of Our Products

Bioreaction Systems/Fermenters

Pilot and lab scale bioprocess/fermentation systems are customized according to customer needs and applications to provide the best solutions. Likely applications are cell culture, biofuel processing, microbial fermentation, waste treatment, biopolymer production and biogas production from biomass.



Reaction/Sorption Systems

Pilot and lab scale reaction systems, incorporating upstream and downstream conditioning, reaction/sorption and analysis units. Likely applications are catalyst research/development, sorption studies, reaction kinetics studies, materials development for sequestration.



Carbon and Nitrogen Analyzers

Analyzers for determination of carbon, carbon species and nitrogen in soil, sludge, biomass, fertilizer, foodstuff, sheet metals, surface/drinking/waste/discharge water, coal and minerals and alike matrixes.



Online TOC-Monitoring Analyzers

Analyzers for determination of carbon, carbon species and nitrogen in soil, sludge, biomass, fertilizer, foodstuff, sheet metals, surface/drinking/waste/discharge water, coal and minerals and alike matrixes.



Specifications of Carbon and Nitrogen Analyzers



	TRL-CN	TRL-TOC-S	TRL-TOC-L	TRL-ROC	TRL-SC
Method of analysis	High Temperature Catalytic Oxidation				
Carbon Detection	NDIR	NDIR	NDIR	NDIR	NDIR
Nitrogen Analysis	with optional TRL-TN	with optional TRL-TN	with optional TRL-TN	N/A	N/A
Nitrogen Detection	Chemiluminescence	Chemiluminescence	Chemiluminescence	N/A	N/A
LOD for Carbon in gr	1ug	1ug	0.25ug	1ug	50ug
LOD for Nitrogen gr	1ug	1ug	0.1ug	N/A	N/A
LOD for Carbon in concentration	1ppm	1ppm	4-50ppb depending on higher concentration range	1ppm	10mg/sqm
LOD for Nitrogen concentration	50ppb	50ppb	20ppb	N/A	N/A
Analysis range for Carbon	100%	100%	30000 to 60000ppm	100%	10g/sqm
Analysis range for Nitrogen	50000ppm	50000ppm	10000ppm	N/A	N/A
Type of Sample	Solid and Liquid	Solid and Liquid	Liquid	Solid and liquid	Metal sheets
Analyzed Parameters	Total Carbon and Optional Nitrogen	TC, IC, Optional TN	TC, IC, TOC(NPOC), Optional TN	TOC400, ROC(EC), TIC900	Surface Carbon
Calculated Parameters	None	TOC	None	None	None
Furnace Temperature	Adjustable dual furnace, operating between 450-1100°C	Adjustable dual furnace, operating between 450-1100°C	Adjustable dual furnace, operating between 450-1100°C	Temperature ramp program, up to 1000°C	Adjustable dual furnace, operating between 450-1100°C
Sample Loading for TC/TN/ TOC Analysis	In sample boat	In sample boat	In 40mL vials	In sample boat	In sample boat
Sample Loading for IC Analysis	N/A	In 40mL vials	the same vial is for all parameters	N/A	N/A
Sample Loading Automation	Full automation	Full automation for TC analysis	With optional TRL-LSA unit	Full automation	Full automation
Manual Sample Loading	N/A	Solid and Liquid samples for IC analysis	Sample suction from sample cup	N/A	N/A
IC Analysis	N/A	Single shot s/w operation	By selecting through s/w	By selecting through s/w	N/A
Sample Dilution	N/A	N/A	By selecting through s/w	N/A	N/A
Flow Modes	Dual	Dual	Single	Dual	Single
Carrier Gas Flow Control	By Mass Flow Control Valve driven via s/w	By Mass Flow Control Valve driven via s/w	By Mass Flow Control Valve driven via s/w	By Mass Flow Control Valve driven via s/w	By Mass Flow Control Valve driven via s/w
Carrier Gas Conditions	100-2500mL/min, operator adjustable, MFC controlled	100-2500mL/min, operator adjustable, MFC controlled	100-300mL/min, operator adjustable, MFC controlled	100-2500mL/min, operator adjustable, MFC controlled	100-1000mL/min, operator adjustable, MFC controlled
Operating Conditions	5 to 45°C	5 to 45°C	5 to 45°C	5 to 45°C	5 to 45°C
Power	1100VA, 230VAC	1100VA, 230VAC	1100VA, 230VAC	1100VA, 230VAC	1100VA, 230VAC
Dimensions, Analyzer, HxWxD	65x123x63 cm	65x123x63 cm	65x59x63 cm	65x123x63 cm	65x123x63 cm

