

CDQC Analysis System

Carbon Dioxide Quality Control System



Application and Analysis Requirements



Raw carbon dioxide (CO₂) is commonly sourced from ammonia plants, ethanol plants, and other fermentation sources. For use in food and beverages, proper removal of certain compounds in these processes is critical because many of them can pose health risks and impact beverage odor and taste. As a result, ultra-pure CO₂ gas suppliers and bottlers continuously check product quality for part-per-million (PPM) or even part-per-billion (PPB) levels of these impurities. Impurity limits and the need to continuously monitor may vary depending on the customer and raw CO₂ source.

Typical Impurity Requirements for Food & Beverage Grade Carbon Dioxide

Impurity	Limit (typical)
Carbon Dioxide (CO ₂) Purity	99.9% min
Acetaldehyde (C ₂ H ₄ O)	0.2 ppm max
Ammonia (NH ₃)	2.5 ppm max
Aromatic Hydrocarbon	20 ppb max
Benzene (C ₆ H ₆)	20 ppb max
Carbon Monoxide (CO)	10 ppm max
Methanol (CH ₃ OH)	10 ppm max
Moisture (H ₂ Ov)	20 ppm max
Nitric Oxide (NO)	2.5 ppm max
Nitrogen Dioxide (NO ₂)	2.5 ppm max
Oxygen (O ₂)	30 ppm max
Sulfur Dioxide (SO ₂)	1 ppm max
Total Sulfur	0.1 ppm max
Total Volatile Hydrocarbons	50 ppm max

CDQC System Overview

Teledyne's Carbon Dioxide Quality Control (CDQC) system offers an integrated package to continuously monitor impurities in carbon dioxide (CO₂). The plug-and-play design allows for the user to select only the gases and features of interest to maximize cost benefit and space.

Front door viewing windows allow for view of all analyzer displays, flow and pressure settings. Stainless steel tube fitting connections and NPT or metric electrical ports as required are conveniently located in a central location for ease of access. Sample conditioning, utility gas provisions and integral calibration gas solenoid valves are standard.

Features

- Single-bay/double-bay NEMA-12 powder coated steel cabinet with full door viewing windows
- 316 stainless steel tubing and fittings (sulfur-treated runs for trace sulfur analysis)
- Tube fitting connections (1/4" as standard, others available)
- FNPT electrical ports (metric available)
- Remote and auto-calibration capabilities
- Sample system included

Options

- Multi-point stream selection, controlled by Profibus-DP or discrete signals
- Stainless steel cabinet, NEMA or IP rated, climate control available
- Profibus-DP communications of most analyzers
- Integral zero air generator to eliminate zero air utility requirement



Impurity	Analyzer
Benzene / Acetaldehyde / Methanol	4000 Series Ultra-Fast Gas Chromatograph
Carbon Monoxide (CO)	GFC-7001T Gas Filter Correlation Analyzer
Moisture	3000TA Trace Oxygen Analyzer
NO _x / Ammonia (NH ₃)	9110T NO / NO ₂ / NO _x Analyzer 9130T Chemiluminescent Ammonia (NH ₃) Gas Analyzer
Oxygen	3000TA Trace Oxygen Analyzer
Total Hydrocarbons	4020 Total Hydrocarbon Analyzer
Total Hydrocarbons (Methane / Non-Methane)	4040 Methane / Non-Methane Analyzer
Total Sulfur	6200T Total Sulfur Analyzer

Model 3000TA Process Trace Oxygen Analyzer

The Model 3000TA Process Trace Oxygen Analyzer uses a fast recovery InstaTrace Micro-fuel cell to measure trace levels of O₂ in sample gas. This analyzer comes standard with the following:

- Three user-selectable ranges (minimum 0-10 ppm FS) plus 0-25% cal range
- 0-1 VDC and 4-20 mADC signal outputs
- Full duplex RS-232 communication link
- Two fully adjustable concentration alarm set points with programmable relay functions



4000 Series Ultrafast Gas Chromatograph

Teledyne's 4000 Series GC incorporates multiple patents to achieve trace detection of methanol, acetaldehyde and low PPB BTEX in under 5 minutes total cycle time.

- Flame Ionization, Thermal Conductivity, Flame Photometric and Dielectric Barrier Discharge detectors are available
- Up to 6 x 4-20 mADC (isolated) outputs (MODBUS-TCP optional)
- Chromperfect® chromatography data system



Total Hydrocarbon and Methane/Non-Methane Analyzers

Model 4020 Total Hydrocarbon Analyzer

The Model 4020 uses a field-proven FID detector to measure THC in various streams including CO₂. This instrument is ideal for monitoring hydrocarbon contamination in high purity bulk gases.

- User programmable ranges: 0-10, 0-100, 0-1000ppm HC standard
- 0-1 VDC and 4-20 mADC, isolated current output
- Adjustable alarm and oven settings
- Auto-fuel shutoff valve
- All pneumatic controls accessible from the front panel



Model 4040 Methane / Non-Methane Analyzer

The Model 4040 is a microprocessor-based, oven heated methane and non-methane gas analyzer designed to measure varieties of hydrocarbon concentrations from a sampling point. It uses FID to measure total hydrocarbons in ppm in a sample gas stream plus temperature controlled sampling system with GC column to give accurate readings of both methane and non-methane hydrocarbons in a gas stream.

- User programmable ranges: 0-10, 0-100, 0-1000ppm HC standard
- 0-1 VDC and 4-20 mADC, isolated current output
- Adjustable alarm and oven settings

Model 6200T Total Sulfur Analyzer

The Model 6200T Total Sulfur Analyzer utilizes proven UV fluorescent technology to continuously detect sulfur found in inert gas streams. A quartz catalytic converter is employed to convert the sulfur, when mixed with scrubbed ambient air, into SO₂ via high temperature oxidation. An internal vacuum pump is employed to draw both the sample and the ambient air into the converter.

- Ranges of 0-50 ppb to 0-20,000 ppb TS (user-selectable)
- Up to 4 analog outputs, 4-20 mA (isolated) or settable voltage type (0-100 mV, 0-1V, 0-5V, 0-10V)
- Ethernet and 2 x RS-232 digital outputs
- Comes complete with Sample Converter Module, Analysis Module and Calibration Module (optional)



Model GFC-7001T Infrared Analyzer

The GFC Series gas filter correlation analyzers measure low ranges of gases (CO, CO₂ and N₂O) detecting models available by comparing infrared energy absorbed by a sample to that absorbed by a reference according to Beer-Lambert Law. All GFC Series instruments offer an advanced color display, capacitive touch screen, intuitive user interface, flexible I/O and built-in data acquisition capability.

- Ranges of 0-1 ppm to 0-1,000 ppm full scale
- Ethernet and 2 x RS-232 digital outputs
- Up to 4 analog outputs, 4-20 mA or settable voltage type (0-100 mV, 0-1V, 0-5V, 0-10V)

Models 9110T / 9130T Nitrogen Oxides & Ammonia Analyzers

The 9110T uses proven chemiluminescence detection coupled with state-of-the-art micro processor technology to provide the sensitivity, stability and ease of use needed for beverage grade CO₂ monitoring levels of oxides of nitrogen. The integral sample system includes an ozonator, reaction chamber and all flow meters, regulators, valves, tubing and fittings.

The 9130T incorporates an additional converter to report ammonia in addition to NO_x. This analyzer uses the chemiluminescence principle and an external ammonia converter and sampling system to measure ammonia in user-selectable ranges. The analyzer has been designed to overcome the problems of ammonia gas analysis through increased flow, minimum surface area and selected construction materials.

- 9110T Ranges: 0-50 ppb to 0-20 ppm NO_x
- 9130T Ranges: 0-50 ppb to 0-20,000 ppb (user-selectable)
- Ethernet and 2 x RS-232 digital outputs
- Up to 4 analog outputs, 4-20 mA or settable voltage type (0-100 mV, 0-1V, 0-5V, 0-10V)
- Continuous self checking with warning alarms

Optional Accessories

VB Series Valve Boxes

- Sequential stream timing control
- Automatic switch to next stream when the time elapsed.
- Timer indicator of stream elapsed time
- Individual timer of each stream
- Stream selection can be operated in either manual or sequencer
- Pushbutton to select the stream
- Optional Profibus-DP communications



Model 701 Zero Air Generator

- Creates hydrocarbon-free air supply for all FID-based analyzers
- Optional CO or CO and Hydrocarbon scrubber
- Automatic water drain
- Automatic pump control based on flow demand
- Source of purge air for permeation tube ovens



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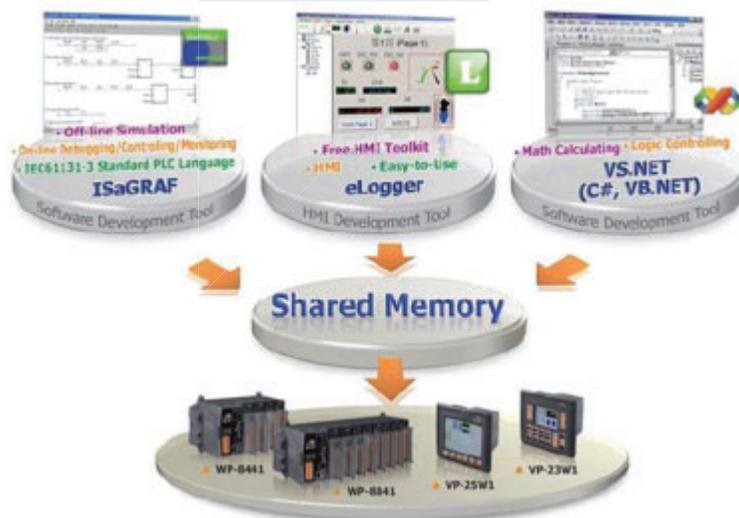
Software:

- Real time display of analyzer output
- Trending of the outputs over time
- Gas detector tube timer control
- Alarm display based on user programmable alarm limits
- Alarm display based on analyzer status
- Statistical process control based on calibration protocol
- Data storage to a selected database
- Valve Box sequencer control
- Certificate of Analysis production and storage
- Display real time trend of analyzers over 6 consecutive days



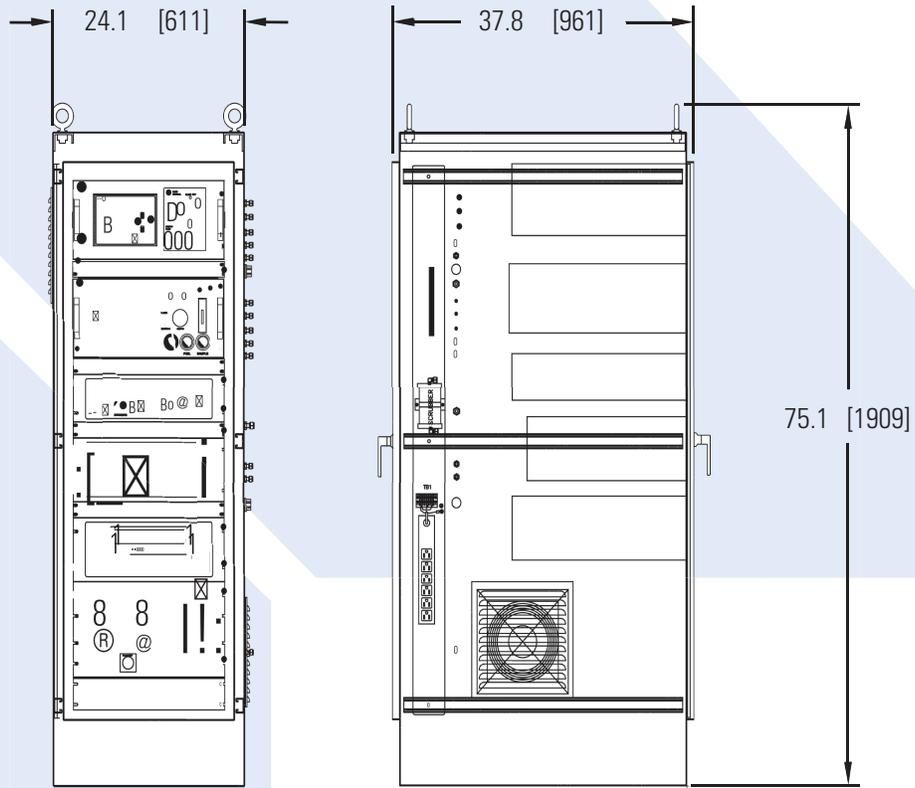
Hardware

- Windows CE based
- Hard Real-Time Capability
- Fast Boot Speed
- PLC Feel
- PXA270 CPU (32-bit & 520 MHZ)
- VGA Port Output or Touch Screen
- Options for MODBUS-TCP, MODBUS-RTU, Profibus-DP and OPC
- Support eLogger & Soft-GRAF HMI
- Support Ms Visual Studio .NET
- Scalable device modules
- Integrated display and control panel
- Ethernet/RS485/RS232 Connectors

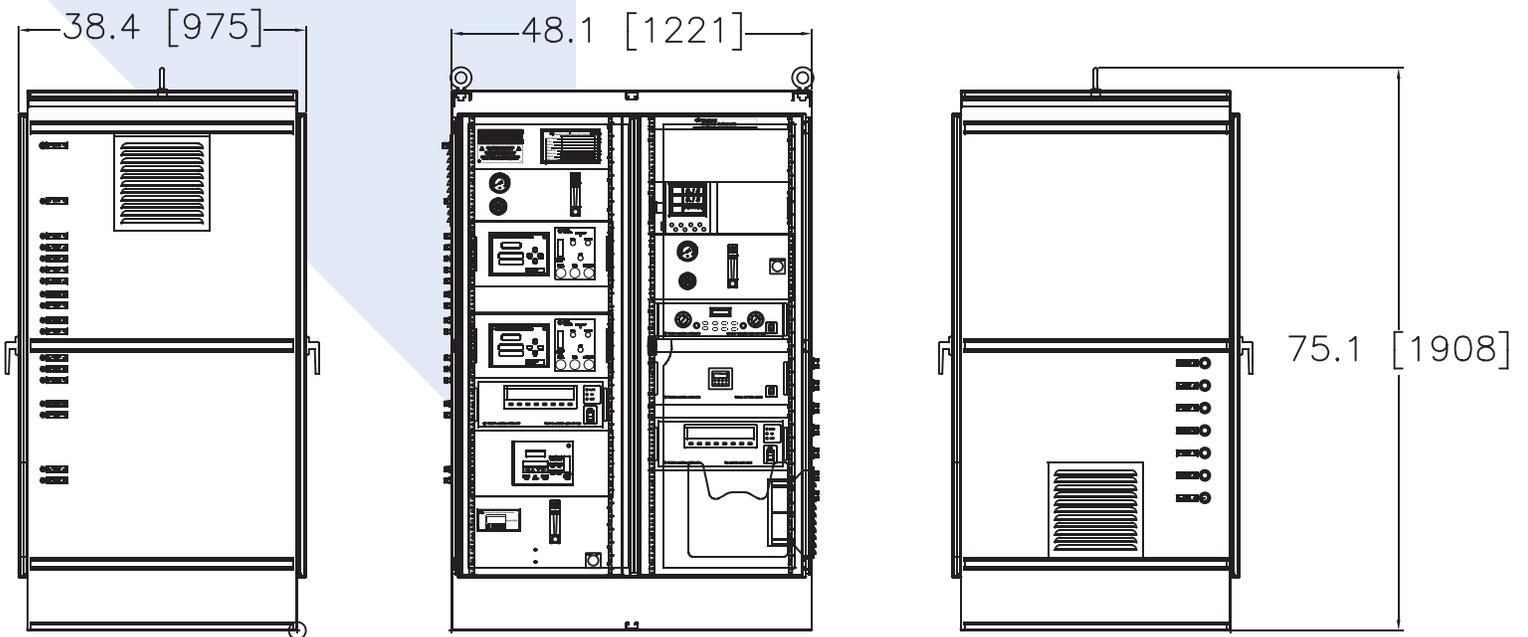


Typical Dimensional Diagrams

Single Bay Cabinet



Double Bay Cabinet





TELEDYNE
ANALYTICAL INSTRUMENTS
 Everywhereyoulook™

CALIFORNIA OFFICE
 CITY OF INDUSTRY, CA
 UNITED STATES OF AMERICA (USA)
 TEL: +1 626.934.1500

COLORADO OFFICE
 ENGLEWOOD, CO
 UNITED STATES OF AMERICA (USA)
 TEL: +1 303.792.3300

MIDDLE EAST OFFICE
 SHARJAH
 UNITED ARAB EMIRATES (UAE)
 TEL: +971.6557.9727

SOUTHEAST ASIA OFFICE
 PETALING JAYA
 MALAYSIA
 TEL: +603.7805.7712

ASK_TAI@TELEDYNE.COM
WWW.TELEDYNE-AI.COM

GOTML@TELEDYNE.COM
WWW.TELEDYNE-ML.COM