Advance Cemas-FTIR NT

Multi-Component Analysis System
for Emission and Process Monitoring

Specification Sheet

10/23-8.11 EN October 2001

- **Continuous, quantitative and selective measurement of HCl, HF, H_2O, CO, CO_2, SO_2, NO_x, NH_3, N_2O, O_2, TOC and NMHC (other gases on request)**
- **Maximum 12 measuring components (standard), simple upgrade on request**
- **Proven hot wet extractive measurement technique**
- **High stability, accuracy and reliability through proven FTIR technology**
- **Fully integrated TOC and O_2 analyzer modules (optional)**
- **Unique air-driven injector pump, no moving parts, low condensate to handle**
- **Low ownership, maintenance and installation cost through multi-component measurement technology with only one sampling system**
- **Complete pre-engineered system, modest space requirement, compact and modular system design**
- **Clear-text status messages and user-friendly operator interface on a large back-lit display**
- **Measured value and status signal transmission to DCS and emission evaluators via analog and digital outputs as well as via Modbus**
- **Remote control and remote maintenance via Ethernet or via modem**
- **Integration and display of signals from other detectors (e.g. dust, mercury, flow, pressure, temperature)**

As a result of the growing requirements in the field of environmental monitoring, increasing number of pollutants and with lower concentrations have to be measured from combustion processes.

World leader in stack gas monitoring systems for more than 40 years and pioneer in FTIR technology, ABB Analytical is offering an inexpensive and forward-looking system with the Advance Cemas-FTIR NT (ACF-NT) multi-component emission and process monitoring system.

Recognized by the process industries for their ruggedness, the ABB FTIR spectrometers offer a measurement technology with the highest levels of accuracy, selectivity and reliability. As a result of the FTIR measurement principle, the spectrometer is free from drift and does not require frequent calibrations, therefore there is no need to hold stocks of expensive, dangerous and toxic test gases.

Because it can easily be expanded through software to measure additional infrared-active components, the ACF-NT system is also designed to expand with your future needs.

The sampling probe, sampling line and analyzer cell are heated allowing water vapor to be measured along with extremely low detection levels of pollutant such as HCl, NH_3 and HF.

The sample gas delivery is using an electronically controlled air injector, which creates a vacuum. This draws the sample gas into the analyzer cell without the use of a mechanical pump. Thus, no moving part is used resulting in less maintenance. As a beneficial side effect, the sample gas is diluted at the analyzer cell outlet, condensation is reduced and disposal of the exhaust gas is safer.

Applications

- Municipal waste incinerators
- Biomedical and sludge incinerators
- Hazardous waste incinerators at chemical plants
- Gasification and pyrolisis processes
- Cement kilns
- Solvent recovery and destruction
- DeNOx and DeSOx of power plants
- Crematoria
- Steel and Aluminum smelters
- Brick, tiles and glass manufacturing
- Catalyst protection monitoring
- Combustion research

Devices and Subassemblies of the System

Sampling System

- Probe tube, optionally heated, lengths 500 to 2500 mm for process temperature up to 500°C (optional up to 1350°C)
- Filtering device, heated to 180°C
- Sample gas lines, heated to 180°C, length up to 35 m (other lengths and temperature on request)
- Protective cover for probe (optional)
- Probe back purge module (optional)
- Automatic injection of test gases at probe for drift check (optional)

Sample Gas Conditioning Unit

- Heated sample gas conditioning block with built-in SS-micro-porous filter
- Air driven injector pump module
- Oxygen, TOC and Mercury analyzers connection ports
- Connection and automatic switchover for zero and calibration gas supply
- Flow, pressure and temperature sensors

Analyzers

- FTIR spectrometer with heated sample cell
- O_2 analyzer (ZrO_2 detector, optional)
- TOC analyzer (FID detector, optional)

Control and Display Units

- Display and operator control unit (LCD screen and touch-control keyboard built into cabinet door)
- Advance Optima system controller
- FTIR system controller
- Control modules for the injector pump, Oxygen and FID analyzers
- Interfaces for
  - Measured values and status signals (analog and digital outputs or Modbus)
  - Remote operation and diagnostics (Modem or Ethernet)
- UPS (optional)

Air Purification

A compressed-air purification unit (molecular sieve) is used to provide zero gas for the FTIR spectrometer and the oxygen analyzer. Purge air is also used by the spectrometer and also to purge the measurement system in the event of heating failure or loss of power.

Operation

The software installed in the controller operates the system completely automatically. It allows the following functions:

- Display all measured results and clear status messages
- Manual operation of the system for service and commissioning
- Remote diagnosis via Ethernet interface and/or modem
- Self-diagnosis and archival of the status signal and measured data
- Optional automatic correction for dry/wet basis and reference measurement (to a fixed O_2 value)
- The FTIR results are averaged over 120 seconds (default setting) to allow for minimal measuring ranges. Through the sliding average the analytical results refreshment time is < 40 seconds. Shorter averaging and refreshment time available (depending on the ranges).

The system controller continuously monitors the temperature, pressure and gas flow to ensure automatic correction, reliability and precise measurement. If the temperature of any heated module of the ACF-NT falls below the minimum allowed, a stream of clean air purge is triggered to protect all subassemblies that are in contact with the sample gas.

The serial communication via Ethernet interface allows the analyzer system to be coupled to the plant network and a telephone modem to the ABB Service Department for remote diagnosis and preventive maintenance scheduling which enables maximum system availability.

Calibration

All FTIR device-dependent factors are taken into account through the daily automatic recording of the zero spectrum. Since absorption spectra are absolute and do not drift, zero and span are effectively automatically corrected using zero gas only.

Cost of ownership reduction is achieved by using the same test gas cylinder for span of the oxygen analyzer and zero of the TOC analyzer.

Manual calibration check with gases and water vapor can easily be done at the analyzer cell or at the sampling probe according to internationally recognized requirements.

Certification and Compliance to International Regulations

The ACF-NT system is approved by the TÜV Rheinland in Germany. It has been successfully tested and achieved the certification according the German and European requirements for emissions protection laws.

The ACF-NT system complies with the CEM performance standards from the UK Environment Agency, and also with the US EPA and ASTM standards issued for FTIR continuous emission monitoring systems (US EPA 40CFR Part 60-PS 15 and ASTM D6348-98).

Technical Data

Measured Components and Measuring Ranges

FTIR [1]	Min. Range	LOD	Min. Range	LOD
SO_2	0-75 mg/m³	0.2 mg/m³	0-25 ppm	0.07 ppm
NO	0-200 mg/m³	1.2 mg/m³	0-150 ppm	0.90 ppm
NO_2	0-40 mg/m³	0.3 mg/m³	0-20 ppm	0.15 ppm
NO_X			0-150 ppm	
N_2O	0-50 mg/m³	0.2 mg/m³	0-25 ppm	0.10 ppm
NH_3	0-15 mg/m³	0.2 mg/m³	0-20 ppm	0.25 ppm
HCl	0-15 mg/m³	0.2 mg/m³	0-10 ppm	0.12 ppm
HF	0-5 mg/m³	0.1 mg/m³	0-5 ppm	0.10 ppm
CO	0-75 mg/m³	0.2 mg/m³	0-60 ppm	0.13 ppm
	Range	**LOD**		
H_2O	0-40 Vol%	0.01 Vol%		
CO_2	0-30 Vol%	0.01 Vol%		
FID	**Min. Range**			
TOC	0-15 mg/m³	0.01 mg/m³		
O_2 Sensor	**Range**	**LOD**		
O_2	0-25 Vol%	0.20 Vol%		

1) FTIR spectrometer performance is based on 120 seconds data acquisition time and standard deviation 3σ

Other measured components and measuring ranges on request.

Performances

Cross-sensitivity
< ±4 % of the smallest measuring range

Linearity
< ±2 % of the smallest measuring range

Sensitivity drift
< 4 % in 6 months

Zero drift
corrected automatically

Response time
T_{90} < 150 seconds, display refreshment time < 40 seconds

Temperature drift
< ±2 % of the smallest measuring range per 10 K change

Air pressure influence
None (automatically controlled through the aspirator pump module)

Availability
> 98 %

Input, Output and Status Signals

Measured signals
4...20 mA per measured component
optional: Modbus, Ethernet communication

Status signals
Output and status signals from the measured concentrations, gas transport, sample conditioning system and operation are displayed on the built-in LCD display
Status signals: System failure, Oxygen analyzer failure, Maintenance, Maintenance request

Input signals
Analog and digital signals possible

Power Supply

Input voltage
400/230 VAC or 230/115 VAC, 48...62 Hz

Power consumption
Analysis system incl. probe filter approx. 2,400 W at power-up, approx. 1,600 W during operation,
Heated sampling line approx. 90 W/m,
Optional air conditioning unit approx. 1,400 W

Sample Gas Inlet Conditions

Temperature
180°C ± 40°C via heated sample gas line

Pressure
80 kPa...105 kPa (0.8 bar...1.05 bar)

Flow rate
approx. 250 l/h

Gas Connections

Sample gas inlet
Pg 42 with special flanged connector

Sample gas outlet
Screw fitting (PVDF) for hose 6/10 x 2 mm

Test gases
Screw fittings for hose (PTFE) 4/6 x 1 mm

Compressed air
Connected to the aspirator pumps and compressed-air purification unit (hose 4/6 x 1 mm). The requirement is for oil-free compressed air at 5–7 bar (70–100 psi), up to 1,700 l/h (1 cfm) for the FTIR analyzer, additionally 1,400 l/h (0.8 cfm) for the optional FID.

System Design

Free standing cabinet in sheet metal. Air conditioning unit optional

Protection class
IP 54/Nema 3 and 13

Dimensions
800 x 2100 x 600 mm (W x H x D)

Weight
Approx. 300 kg

When installing the equipment, a space of approx. 600 mm should be allowed on the right hand side for the pipes, cable connections and air conditioning unit.

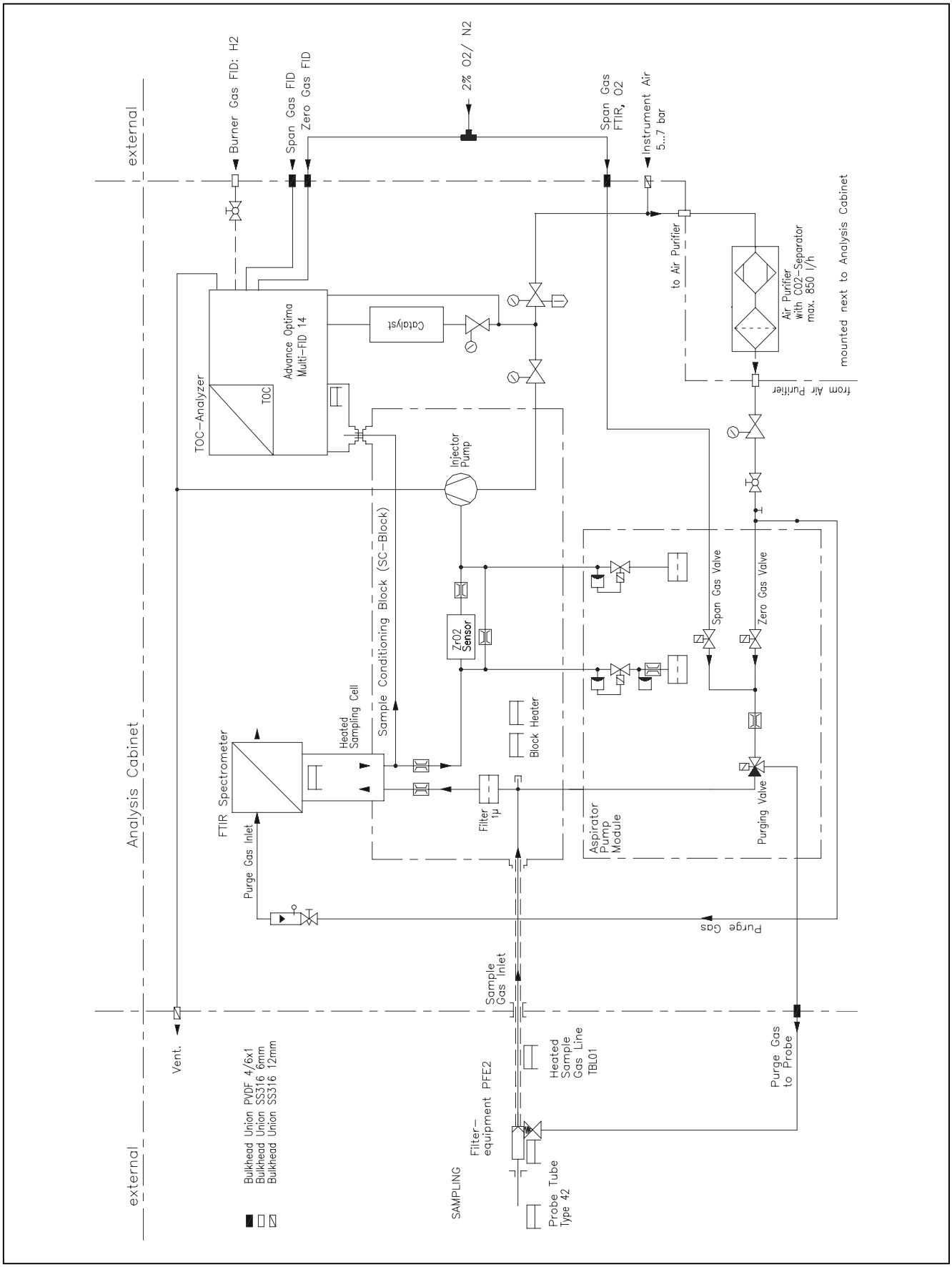
Environmental Conditions

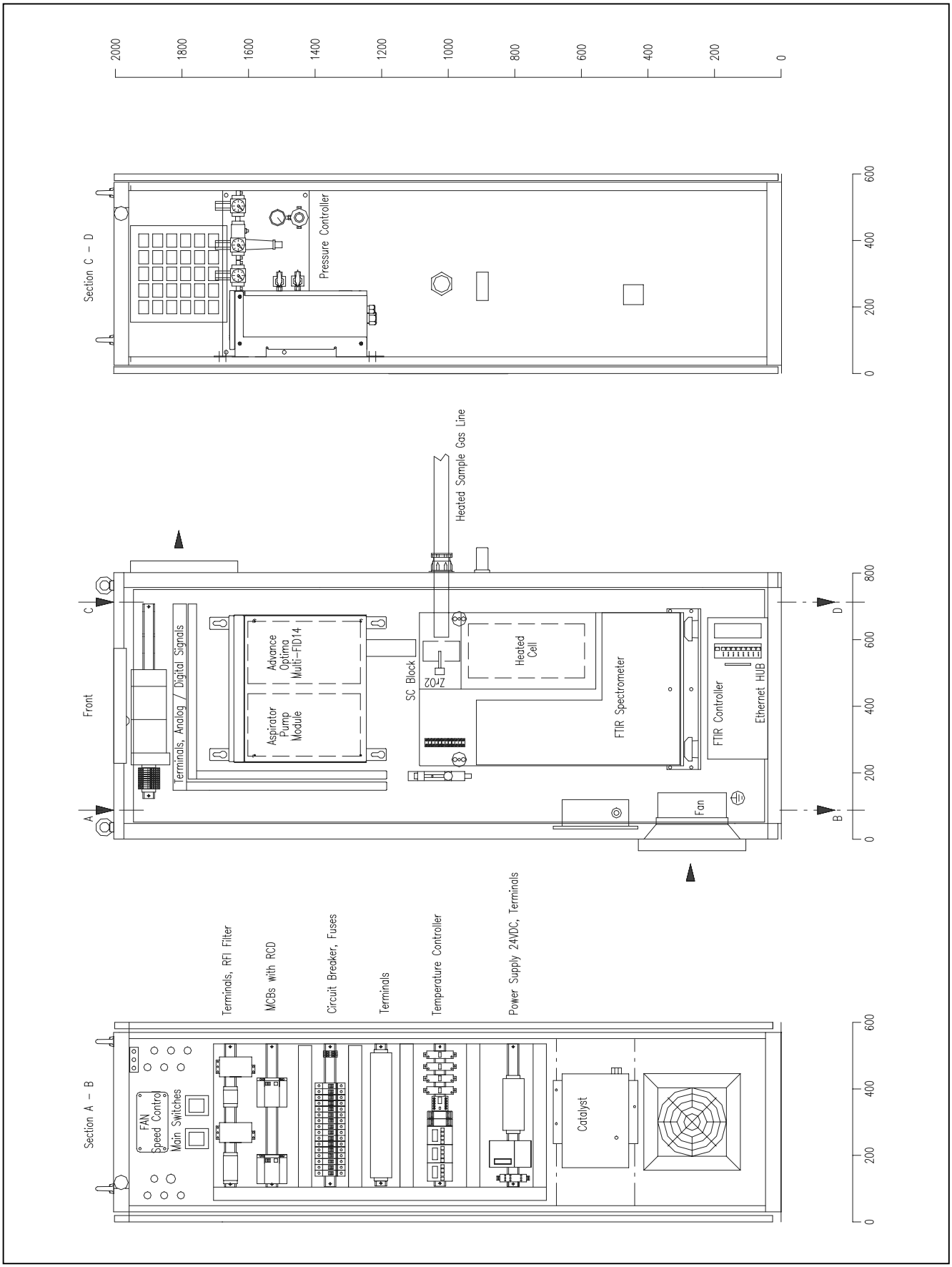
Ambient temperature
in operation
in air conditioned rooms +20 to +25 °C
with air conditioning unit (optional) +5 to +40 °C
for short periods up to +45 °C
during storage and transport –25 to +65 °C

Relative humidity
≤ 75 % as an annual average, max. 95 % for short periods, occasional and light condensation is permissible, supposed powered and purged system

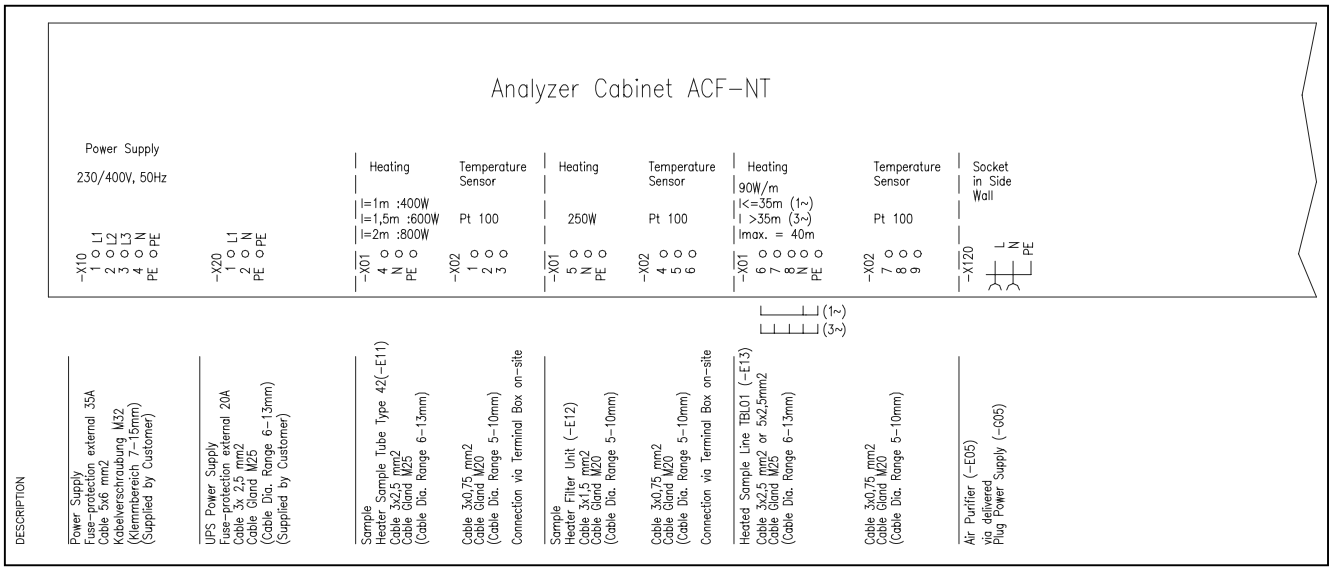
Installation site
The system should be protected against radiated heat, heavy concentrations of dust and corrosive atmospheres.

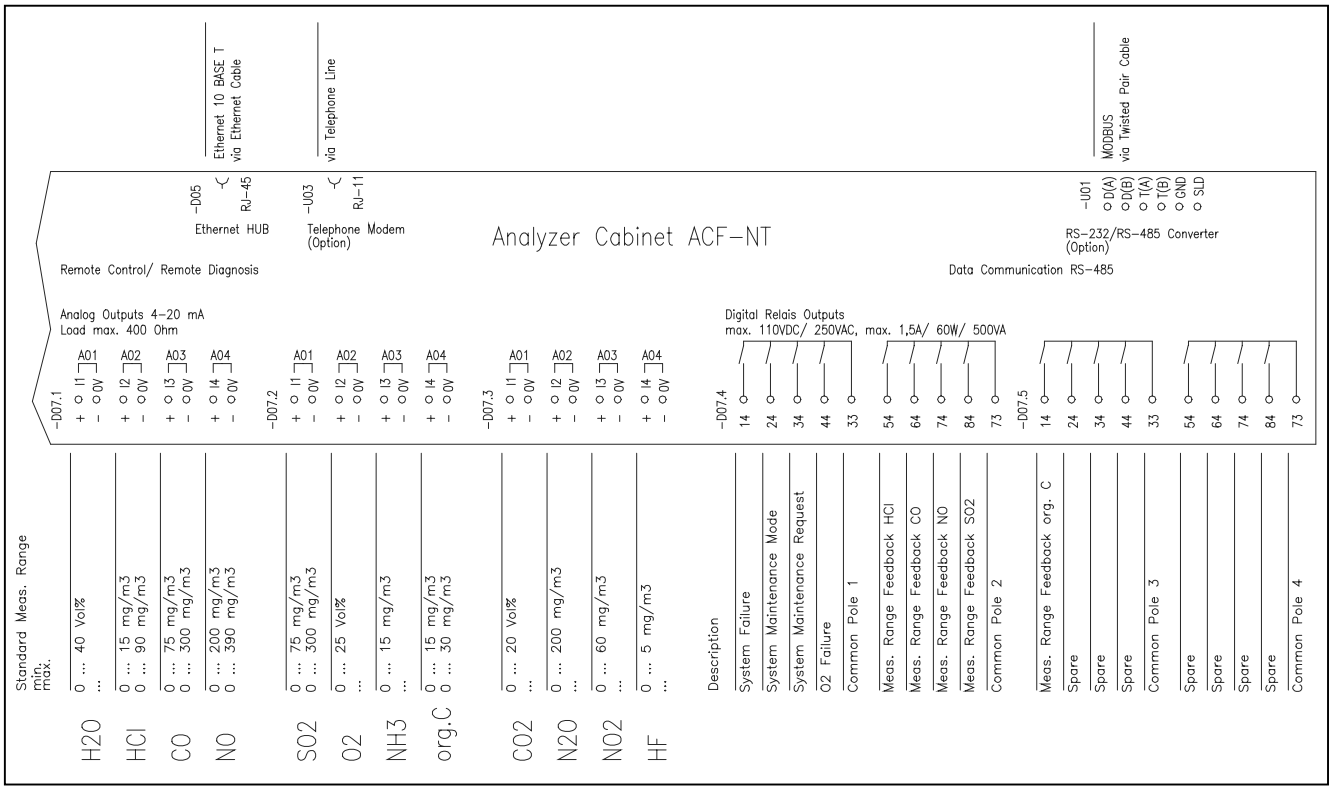
Pneumatics Diagram




2000
1800
1600
1400
1200
1000
800
600
400
200
0
Section C – D
Pressure Controller
0
200
400
600
Heated Sample Gas Line
C
D
Front
A
B
Terminals, Analog / Digital Signals
Advance Optima Multi-FID14
Aspirator Pump Module
SC Block
ZrO2
Heated Cell
FTIR Spectrometer
FTIR Controller
Ethernet HUB
Fan
0
200
400
600
800
Terminals, RFI Filter
MCBs with RCD
Circuit Breaker, Fuses
Terminals
Temperature Controller
Power Supply 24VDC, Terminals
Section A – B
FAN Speed Control
Main Switches
Catalyst
0
200
400
600

Connection Diagrams





Ordering Information

Ordering No. 23916-0-												
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Gas Analyzers												
Basic system with FTIR-Analyzer incl. H_2O measurement component												
Built-in gas cell 6.4 m optical length for emission monitoring up to 40 Vol% H_2O	**1**											
Built-in gas cell 3.2 m optical length for emission monitoring up to 60 Vol% H_2O	**2**											
Optional sensors												
Without oxygen analyzer		**0**										
Built-in ZrO_2 Sensor for O_2, meas. range 0…25 Vol%		**1**										
Without FID			**0**									
Built-in Multi-FID 14 TOC, measurement range adjusted for 0...15 mg TOC/m^3 For other ranges use BA-No. 371/372			**1**									
Analog interface for measurement values												
Without analog outputs				**0**								
4 outputs 4…20 mA				**1**								
8 outputs 4…20 mA				**2**								
12 outputs 4…20 mA				**3**								
Serial interface for measurement values and status signals RS 485												
Without					**0**							
Modbus (line length up to 1.200 m)					**1**							
Modbus via fiber optic cable (line length up to 3.300 m)					**2**							
Serial interface and software for remote control and diagnosis												
Without						**0**						
Phone modem						**1**						
Ethernet, connector RJ45						**2**						
Ethernet, connector RJ45 + phone modem						**3**						
Ethernet, fiber optic cable						**4**						
Ethernet, fiber optic cable + phone modem						**5**						
Sampling & conditioning												
Without probe tube							**0**					
Probe tube 40 not coated, stainless steel (1.4571)												
Nominal length 500 mm							**1**					
Nominal length 1000 mm							**2**					
Nominal length 1500 mm							**3**					
Nominal length 2000 mm							**4**					
Nominal length 2500 mm							**5**					
Probe tube 40 coated, stainless steel (1.4571)												
Nominal length 500 mm							**6**					
Nominal length 1000 mm							**7**					
Nominal length 1500 mm							**8**					
Nominal length 2000 mm							**9**					
Nominal length 2500 mm							**A**					
Probe tube 42 heated (temperature controller see BA-No. 308)												
Nominal length 1000 mm							**B**					
Nominal length 1500 mm							**C**					
Nominal length 2000 mm							**D**					

Ordering Information

Filter unit												
Without probe filter unit								**0**				
Filter unit PFE2												
Without protection box, with heating unit and insulation, 1x Pt100, with check valve (Catalog No. 23028-0-12223)								**1**				
With protection box, with heating unit and insulation, 1x Pt100, with check valve (Catalog No. 23028-0-22223)								**2**				
Without protection box, with heating unit and insulation, 1x Pt100, with check valve, with pneumatic (Catalog No. 23028-0-12224)								**3**				
With protection box, with heating unit and insulation, 1x Pt100, with check valve, with pneumatic (Catalog No. 23028-0-22224)								**4**				
Heated sample line												
Without sample gas line									**0**			
Sample gas line TBL01 with heating, line length ... m (use BA-No. 303) (230 V: Catalog No. 23283-0-131511, 115 V: Catalog No. 23283-0-131512)									**1**			
Power supply												
230/400 V, 48 to 62 Hz, without UPS										**1**		
115/200 V, 48 to 62 Hz, without UPS										**2**		
230/400 V, 48 to 62 Hz, with UPS										**4**		
115/200 V, 48 to 62 Hz, with UPS										**5**		
Cabinet version												
Without air conditioning unit, without base											**0**	
Without air conditioning unit, with base											**1**	
With air conditioning unit, without base											**2**	
With air conditioning unit, with base											**3**	
Measurement components												
CEM package: Ranges pre-configured according to European Regulation HCl 0 to 90 mg/m^3 CO 0 to 300 mg/m^3 SO_2 0 to 300 mg/m^3 NO 0 to 392 mg/m^3 (corresponds to 0 to 600 mg/m^3 NO_2) H_2O 0 to 40 Vol%												**1**
For individual configuration of components and ranges use BA-No. 310-421												**2**
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Ordering No. 23916-0-												

Additional Ordering Information

	BA-No.
Measuring component HCl	310
Range 1: 0 to ... mg/m^3 or ppm	311
Range 2: 0 to ... mg/m^3 or ppm	312
Measuring component CO	320
Range 1: 0 to ... mg/m^3 or ppm	321
Range 2: 0 to ... mg/m^3 or ppm	322
Measuring component SO_2	330
Range 1: 0 to ... mg/m^3 or ppm	331
Range 2: 0 to ... mg/m^3 or ppm	332
Measuring component NO	340
Range 1: 0 to ... mg/m^3 or ppm	341
Range 2: 0 to ... mg/m^3 or ppm	342
Range switching for ranges BA-No. 312, 322, 332, 342	345
for other measuring components	346
Measuring component H_2O	350
Range: 0 to ... Vol%	351
Measuring component O_2	360
Range: 0 to ... Vol%	361
Measuring component org. C_{total}	370
Range 1: 0 to ... mg/m^3 or ppm	371
Range 2: 0 to ... mg/m^3 or ppm	372
Measuring component NH_3	380
Range: 0 to ... mg/m^3 or ppm	381
Measuring component CO_2	390
Range: 0 to ... Vol%	391
Measuring component NO_2	400
Range: 0 to ... mg/m^3 or ppm	401
Measuring component N_2O	410
Range: 0 to ... mg/m^3 or ppm	411
Measuring component HF	420
Range: 0 to ... mg/m^3 or ppm	421
Temperature control of the heated probe 42	308
Heated sample line TBL01 length … m (up to 35 m)	303
Special version	300
Software parameters	
Results based on dry basis	430
Results normalized by O_2 value	431
Connection of an external analyzer to the heated sampling system (e.g. Mercury)	449
Daily drift check	450
Installation	upon request
Start up	
Maintenance contract	
System manual German (1 pc free)	G31
System manual English (1 pc free)	G32
Language for HMI: German	451
Language for HMI: English	452

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