

FTIR Analyser DATASHEET

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ACF-NT

Multi-Component Analysis System for Emission and Process Monitoring



Continuous, quantitative and selective measurement of HCl, HF, H₂O, CO, CO₂, SO₂, NO, NO₂, CH₄, NH₃, N₂O, H₂CO, CH₃OH, O₂ and VOC (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 VOC and O₂ analyzers (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, Profibus or Ethernet

Local control for service purposes via Ethernet and remote maintenance via modem

Integration and display of signals from other detectors (e. g. dust, mercury, flow, pressure, temperature)

Description

ACF-NT Analysis System

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 decades and pioneer in FTIR technology, ABB Analytical is offering an inexpensive and forward-looking system with the ACF-NT multi-component analysis system for emission and process monitoring.

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 analysis 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, NH₃ 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 pyrolysis processes
- Cement kilns
- Solvent recovery and destruction
- DeNO_x and DeSO_x 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 60 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-microporous filter
- Air driven injector pump module
- Connection ports for oxygen and VOC analyzers and for third-party analyzers
- Connection and automatic switchover for zero and calibration gas supply
- Flow, pressure and temperature monitoring

Analyzers

- FTIR spectrometer with heated sample cell
- Oxygen analyzer (ZrO₂ detector, optional)
- VOC analyzer (FID detector, optional)

Control and Display Units

- Display and operator control unit built into cabinet door
- AO2000 system controller
- FTIR system controller
- Control modules for the injector pump, oxygen and VOC analyzers
- Interfaces for
 - Measured values and status signals (analog and digital outputs; Modbus, Profibus and Ethernet optional)
 - Remote control and diagnostics (Modem and/or Ethernet)
- Prepared for UPS for uninterrupted power supply of the most important subassemblies (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 analysis system in the event of heating failure or loss of power.

Operation

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

- Display of all measured results and clear status messages
- Manual operation of the system for commissioning and service
- Local operation for service purposes via Ethernet interface

Description

- Remote diagnosis via modem
- Self-diagnosis of the FTIR spectrometer and archival of the status signal and measured data
- Optional automatic correction for dry/wet basis and reference measurement (to a fixed O₂ 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 analysis system 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 Ethernet interface allows the analysis system to be coupled to the plant network for transfer of measured values and status signals. Data can be read using the AnalyzeIT Explorer or AO2000 OPC Server software tools.

The telephone modem gives access to the ABB Service Department (when enabled by the customer) 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 zero calibration of the oxygen analyzer and the VOC 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

The analysis system is approved by the German TÜV Rheinland. It has been successfully tested and achieved the certification according the German and European requirements for emissions protection laws. Report No. 936/21210471/A dated 13th February 2009

The analysis 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).

The analysis system is CSA certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 and UL Std. No. 61010-1 (2nd Edition).

GOST-R certificate, Rostekhnadzor operation permission and pattern approval certificate for measuring instruments are available for the analysis system.

Technical Data

Measured Components and Measuring Ranges

FTIR ¹⁾	Min. Range	LOD	Min. Range	LOD
SO ₂	0–75 mg/m ³	0.27 mg/m ³	0–25 ppm	0.09 ppm
NO	0–200 mg/m ³	1.65 mg/m ³	0–150 ppm	1.24 ppm
NO ₂	0–40 mg/m ³	0.41 mg/m ³	0–20 ppm	0.2 ppm
CH ₄	0–100 mg/m ³	0.72 mg/m ³	0–150 ppm	1.1 ppm
N ₂ O	0–50 mg/m ³	0.25 mg/m ³	0–25 ppm	0.13 ppm
NH ₃	0–15 mg/m ³	0.20 mg/m ³	0–20 ppm	0.27 ppm
HCl	0–15 mg/m ³	0.26 mg/m ³	0–10 ppm	0.16 ppm
HF	0–5 mg/m ³	0.12 mg/m ³	0–5 ppm	0.13 ppm
CO	0–75 mg/m ³	0.23 mg/m ³	0–60 ppm	0.18 ppm
H ₂ CO	0–20 mg/m ³	0.35 mg/m ³	0–15 ppm	0.26 ppm
CH ₃ OH	0–40 mg/m ³	0.75 mg/m ³	0–30 ppm	0.53 ppm
H ₂ O	0–40 Vol%	0.01 Vol%		
CO ₂	0–30 Vol%	0.01 Vol%		

FID ²⁾	Min. Range	LOD
VOC	0–15 mg/m ³	0.3 mg/m ³

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, standard deviation 3 σ and optical path length 6.4 m.

2) The measuring range can be reduced or enlarged by a factor of max. 4 (to the smallest indicated measuring range).

Measuring ranges within ignition limits cannot be provided.

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
T₉₀ < 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)

Technical Data

System Design

Design

- Free standing cabinet in sheet metal
- Air conditioning unit optional

Protection class

- IP54/NEMA 3 and 13

Dimensions

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

Weight

- Approx. 300 kg

Color

- Light gray (RAL 7035)

Minimum distances for installation

- Left approx. 500 mm for the cable connections
- Right approx. 1000 mm for the pipe connections, air conditioning unit and air purifier
- Front approx. 1000 to open the door (hinged at left)
- Top approx. 500 mm when using the air conditioning unit (optional)

Input, Output and Status Signals

Measured signals

- 4–20 mA per measured component
- optional: Modbus, Profibus, 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, maintenance mode, maintenance request, module error, oxygen analyzer error, VOC analyzer error

Input signals

- Analog and digital signals possible

Gas Connections

Sample gas inlet

- Special support for heated line in the right cabinet wall
- Screw fitting at SC-block for heated line TBL01 (4/6 x 1 mm)

Sample gas outlet

- Screw fitting (steel) for pipe 12 mm

Test gases

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

Instrument air

- Connected to the aspirator pumps and compressed-air purification unit (hose 4/6 x 1 mm).
- Quality: Based on ISO 8573-1 Class 2 (max. particle size 1 µm, max. particle density 1 mg/m³, max. oil content 0.1 mg/m³, max. pressure dew point –20 °C). The requirement is for compressed air at 5–7 bar (70–100 psi), up to 1700 l/h (1 cfm) for the FTIR spectrometer, additionally 1400 l/h (0.8 cfm) for the optional VOC analyzer.

Power Supply

Input voltage

- 230/400 V 3 Ph, N, PE or 120/208 V 3 Ph, N, PE, ±10 %, 48 to 62 Hz
- Non-floating PEN conductor not allowed.

Power consumption

- System incl. probe filter at power-up approx. 2400 W
- during operation approx. 1600 W
- Heated sampling line approx. 90 W/m
- Air conditioning unit (optional) approx. 1400 W
- Prepared for UPS (optional) approx. 600 W

Overvoltage category/Pollution degree

- II/2

Service socket

- 230 VAC or 120 VAC, 48 to 62 Hz, max. 5 A
- (located in the cabinet light)

Sample Gas Inlet Conditions

Temperature

- Controlled at 180 °C ± 2 °C via heated sample gas line

Pressure

- Analysis cabinet inlet to sample gas conditioning block: 900–1100 hPa (0.9–1.1 bar)

Flow rate

- Approx. 250 l/h

Environmental Conditions

Ambient temperature

- In operation
 - In air conditioned rooms +20 to +25 °C
 - With air conditioning unit (optional) +5 to +40 °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 location

- The analysis system is intended for indoor use only. The analysis system should be protected against radiated heat, heavy concentrations of dust, corrosive atmospheres and vibrations.

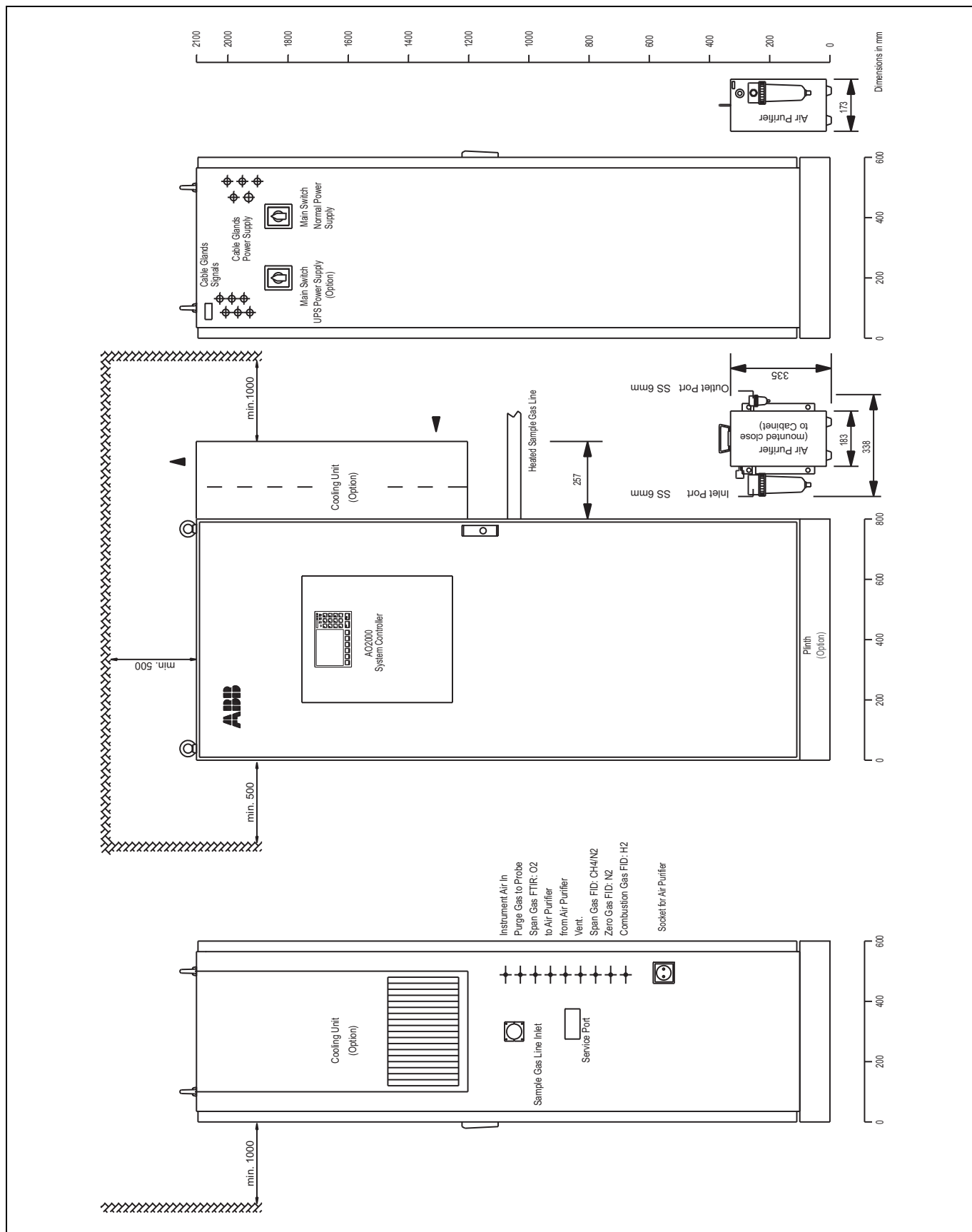
Installation location altitude

- Max. 800 m above sea level (for length of sample gas line incl. probe = 10 m); greater altitudes on request.

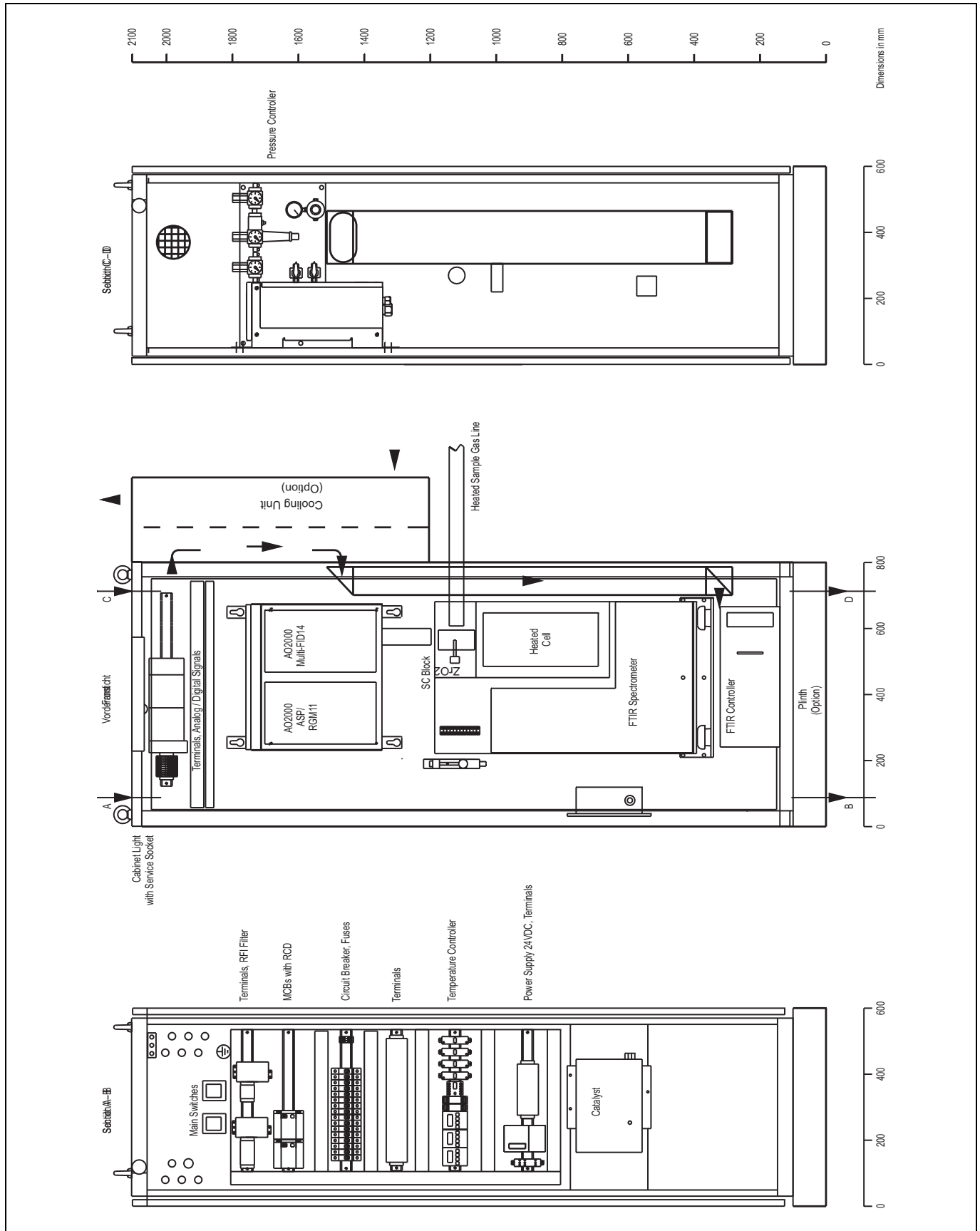
Storage and transport

- It is mandatory that the cabinet or the spectrometer is hermetically sealed during storage and transport.

System Design (Exterior View)



System Design (Interior View)



Connection Diagram Power Supply

Power Supply
 Fuse-protection external 3x20A (3x25A)
 Cable 5x6 mm² or 5xAWG8
 Cable Gland M32
 (Cable Dia. Range 7-15mm)
 (Supplied by Customer)

UPS Power Supply
 Fuse-protection external 20A
 Cable 3x 2,5 mm² Or 3xAWG10
 Cable Gland M25
 (Cable Dia. Range 6-13mm)
 (Supplied by Customer)

Sample
 Heater Sample Tube Type 42(-E11)
 Cable 3x2,5 mm² or 3xAWG14
 Cable Gland M25
 (Cable Dia. Range 6-13mm)

Cable 3x0,75 mm² or 3xAWG16
 Cable Gland M20
 (Cable Dia. Range 5-10mm)

Connection via Terminal Box on-site

Sample
 Heater Filter Unit (-E12)
 Cable 3x1,5 mm² or 3xAWG16
 Cable Gland M20
 (Cable Dia. Range 5-10mm)

Cable 3x0,75 mm² or 3xAWG16
 Cable Gland M20
 (Cable Dia. Range 5-10mm)

Connection via Terminal Box on-site

Sample
 Heated Sample Line TBL01 (-E13)
 Cable 3x2,5 mm² or 5x2,5mm²
 Cable 3xAWG12 or 5xAWG12
 Cable Gland M25
 (Cable Dia. Range 6-13mm)

Cable 3x0,75 mm² or 3xAWG16
 Cable Gland M20
 (Cable Dia. Range 5-10mm)

Air Purifier (-E05)
 via delivered
 Plug Power Supply (-G05)

230V AC or 120V AC, 48...62Hz, max.5A

CAUTION : max. Length of Sample Gas Line at 230/400V:
 35m - 1-phase Fuse-protection (Standard)
 60m - 3-phase Fuse-protection
CAUTION : max. Length of Sample Gas Line at 120/208V:
 15m - 1-phase Fuse-protection (Standard)
 40m - 3-phase Fuse-protection



Power Supply
 230/400V +/-10%, 48...62Hz
 (120/208V +/-10%, 48...62Hz)
 -X10
 1 0 L1
 2 0 L2
 3 0 L3
 4 0 N
 PE 0 PE

-X20
 1 0 L1
 2 0 N
 PE 0 PE

-X01
 10 0
 11 0
 12 0

-X02
 1 0
 2 0
 3 0

-X01
 13 0
 14 0
 15 0

-X02
 4 0
 5 0
 6 0

-X01
 16 0
 19 0
 22 0
 17 0
 18 0

-X02
 7 0
 8 0
 9 0

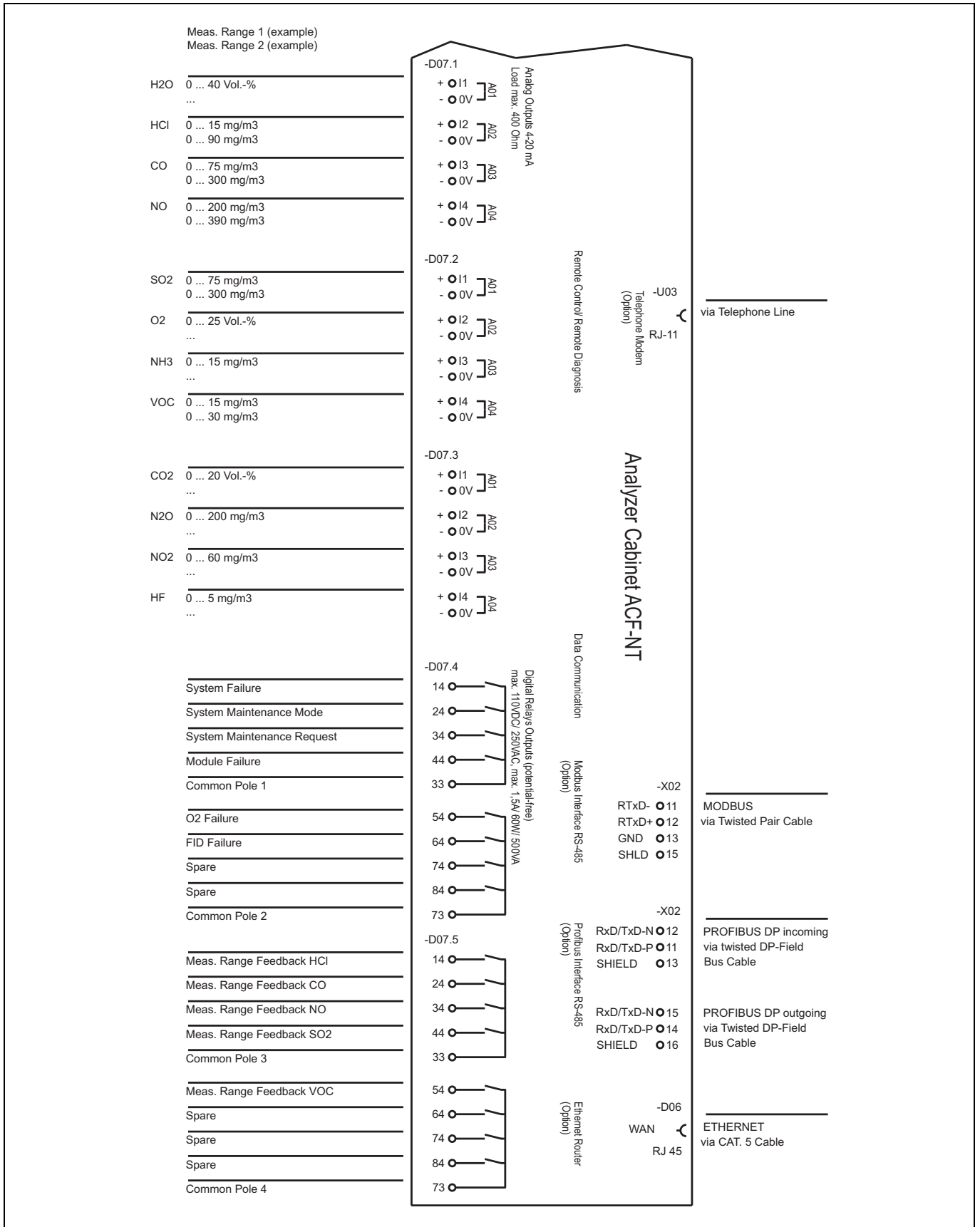
-X120
 Socket
 In Side
 Wall
 L
 N
 PE

-E02
 Socket
 In Cabinet Light
 L
 N
 PE



Analyzer Cabinet ACF-NT

Connection Diagram Signal Lines



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