TFS1-Ex Analyzer

Operator's Manual

Last Updated: 24 May 2019
Revision: 01

TFS1-Ex

Tel: 403.253.4012 Fax: 403.253.4016 Email: info@envent-eng.comwww.envent-eng.comFor further information, or a copy of our most recent operating manual, please visit us at www.envent-eng.com.

TABLE OF CONTENTS:

Figures and Tables:

Figures:

Tables:

Introduction:

About this Manual:

The TFS1-Ex Gas Analyzers are spectroscopic gas analyzers for use in remote locations, running unattended for extended periods of time. This User and Installation Manual provides information about the following Envent TFS1-Ex Gas Analyzers:

- TFS1-Ex: Ex II 2 G Ex db IIB + H2 T3 Gb
  ATEX Certificate Number; ITS16ATEX18435X
  IECEx Certificate Number; IECEx ITS 16.0025X

This manual contains a comprehensive overview of Envent Engineering's TSF1-Ex Analyzers and step-by-step instructions on:

- Installation and Start-up
- Operation
- Maintenance
- Troubleshooting

This manual should be read and referenced by the person who will install, operate, or have contact with the TFS1-Ex Gas Analyzer. Take time to familiarize yourself with the content of this Operator's Manual, reading each section carefully so you can quickly and easily install and operate the analyzer.

Warnings and Cautions:

The manual includes images, tables, and charts that provide a visual understanding of the analyzer and its functions. Take note of all the caution symbols and notes, as they will alert you of potential hazards and important information.

CAUTION: Enclosure window must be secured with a 6-32 x ¾ Inch set screw

WARNING: When cleaning the backpan, clean it only with a damp cloth to prevent static charging hazard

WARNING: Internal ground wiring must be 16 awg (1.31 mm2) minimum. Internal ground wiring is identically sized to the phase conductors. Refer to figure 4 for more details.

WARNING: External ground wiring must be 11 awg (4 mm2) minimum. Refer to figure 4 for more details

WARNING: cable used must be rated to minimum ambient of 70 C

WARNING: Maximum pressure gas inlet to the XP enclosure of 30 psig. Do not apply more than 30 psig to analyzer. Damage to the analyzer may result.

CAUTION: Before applying line pressure be sure that all pressure connections are secure and leak tight.

WARNING: The analyzer enclosure must be affixed to a structure using the supplied brackets and 3/8" bolts and capable of supporting a minimum of 4 times the weight of the analyzer. 1-5/8" Unistrut or equivalent, bolted or welded to the building structure is recommended.

WARNING: Conduit must be properly DE-burred and anti-shorting bushings must be installed to protect wiring from damage. A minimum of 5 threads of engagement is required for rigid conduit in hazardous locations.

CAUTION: The user, through his own analysis and testing, is solely responsible for the product selection and ensuring all responsibility, safety and warning requirements of the application are met. If the equipment is used in a manner not specified by Envent Engineering Ltd., the protection provided by the equipment may be impaired.

CAUTION: Do not use solvents, brake cleaner, soaps or detergents to clean the analyzer and sample conditioning system. CONTACT ENVENT ENGINEERING FOR CLEANING REQUIREMENTS

CAUTION: Dis-assembly of the pressure regulator and solenoids in the field is not advised. Consult the factory if the regulator or solenoid appears contaminated.

CAUTION: The analyzer should be mounted in an enclosed area in which it is not exposed to vibration and excessive pressure, temperature and environmental variations. The TFS1-Ex is certified for Ex II G Ex db IIB + H2 T3 Gb. Ensure that the analyzer received is suitable

for the area classification of the installation.

CAUTION: Turn off power before servicing. Ensure supply is off before connecting or disconnecting supply power.

WARNING: (DC Power) This unit requires a disconnect device rated 24 VDC and 5 A maximum, certified for the hazardous area of the installation and must be protected by a circuit breaker rated 24 VDC and 5 A maximum.

WARNING: (AC Power) This unit requires a disconnect device rated 240 VAC and 5 A maximum, certified for the hazardous area of installation and must be protected by a circuit breaker rated 240 VAC and 5 A maximum.

WARNING: Electrical connections to the analyzer must use an explosion proof connector or seal.

CAUTION: The analyzer power fuse holder covers must be secured by a wire tie to prevent unintended removal.

WARNING: The name plate affixed to the analyzer details warnings and cautions specific to the model supplied. Read and understand the nameplate warnings and cautions before installing the analyzer.

WARNING: Repair of the flamepaths is not intended.

Conditions of Use

No modifications to the flamepaths are permitted without consultation with the controlled documentation

Only suitably approved Ex db IIB + H2 Gb cable grands, blanking elements or thread adaptors with a service temperature rating of 0 °C to 50 °C to be used

Temperature at branching point may reach 67 °C, as such suitably rated cable must be selected

Tunable Filter Spectroscopy Overview:

Principle of Operation:

The TFS1-Ex Analyzer is a non-contact, light absorption based gas analyzer capable of percent level concentration monitoring of multiple gas compounds. The analyzer consists of a light spectrometer, a flow-through sample cell, a single-element photo-detector, and the supporting electronics. The spectrometer uses a unique Tunable Fabry-Perot assembly that provides wavelength scanning with high optical throughput. An advanced spectral processing algorithm computed in the embedded electronics provides highly accurate and robust quantitative measurements.

The TFS1-Ex Gas Analyzer is configured and calibrated for a specific wavelength analysis region(s) depending on the application for which it is intended. It is designed to be a dedicated on-line monitoring system that only requires periodic on-site span verification and zeroing every three months. The specific system configuration and calibration is denoted by a Factory Serial

Number that can be found in the Final Span Calibration Verification Sheet delivered with the analyzer.
Example applications of the TFS1-Ex Analyzer include:

- Hydrocarbon gas composition monitoring
- Petrochemical process monitoring
- Specialty and chemical gas process and blending monitoring
- Catalysis and combustion process monitoring

Measurement Principle:

When a gas sample is introduced into the gas cell, the light radiation provided by a broadband light source is partially absorbed by the gas species present. The light absorption occurs at specific frequencies and magnitudes depending on the gas compound and the concentration of that compound. The TFS1-Ex Gas Analyzer spectrometer module scans the wavelength and measures the true absorption spectra and compares them with the pre-loaded calibration spectra. The on-board analysis algorithm computes the predicted gas concentrations in real-time.

In principal, the absorption spectrum of each compound is unique which acts as a "fingerprint" for identification or speciation analysis. In addition, the magnitude of the absorption is a function of the number of molecules of the gas. With a known path length, pressure, and temperature, the magnitudes of the absorption spectra are then used to compute volumetric concentrations. This *first principle* based technique provides accurate and robust measurements with minimal span and baseline drifts.
The TFS1-Ex Gas Analyzer employs an internal pressure transducer to measure the sample pressure in real-time enabling pressure variation corrections. The flow cell is heated to a constant temperature (default value is 60°C) with a sample preheat module to maintain both sample and optical sensor temperature at a constant calibrated temperature, thereby ensuring measurement accuracy and stability despite sample and environmental variations.

Technical Specifications:

Performance

Accuracy	+/- 0.2% of full scale per reading
Repeatability	<0.1%
Zero Drift	<0.2% of full scale per month

Application Data

Sample Temperature	0-50°C [(a)]
Sample Humidity	5 – 95% RH non-condensing
Sample Inlet Pressure	0 – 30 psig [(a)]
Sample Flow Rate	100 – 1000 cc/min [(a)]

Electrical & Communications

Input Voltages	24 VDC, 5.0 A max 120-240 VAC, 50/60 Hz, 5.0 A max
Outputs	4-20 mA Analog Outputs (2 standard, optional 8 additional) Serial RS-232, 485 (Communications/Modbus standard) 120 VAC 5AMP Max Relays (4 standard) TCP/IP Ethernet (optional)
Archives	32 MB

Graphics Display	1 to 4 line primary data Scrolling alarm marquee Constant view marquee Scrolling menu system

Physical Specifications

Size	24" x 15" x 8" deep
Weight	<55 lbs (25 kg)

Area Classification

Certification	TFS1-Ex: Ex II 2 G Ex db IIB + H2 T3 Gb ATEX Certificate: ITS16ATEX18435X IECEx ITS 16.0025X

Table 1: Specifications Table

Installation and Start-up

The TFS1-Ex Analyzer was configured, functionally tested and calibrated at the factory. All test and calibration data is documented in the Factory Calibration Report.

CAUTION: The analyzer should be mounted in an enclosed area in which it is not exposed to vibration and excessive pressure, temperature and environmental variations. Ensure that the housing received is suitable for area classification.

The analyzer will be shipped for wall mount mount (for additional options consult the factory).

Note: 3/8" x 1" bolts are recommended for installation.

CAUTION: Excessive temperature and environmental variations may affect the integrity of the calibration gas. Should heavier components condense into the liquid phase, the composition of the bottles will change.

Envent Engineering is available for installation and start-up, if required. See Envent's pre-commissioning guidelines on our website (http://www.envent-eng.com/documents.php).

Sample Point Selection:

The sample to the analyzer must be representative of the process stream and should be taken from a point as close as possible to the analyzer to avoid lag times and sample degradation in the tubing. Sample transport, including sample probe assembly, is generally the responsibility of the end user.
A probe should be installed vertically on a horizontal section of pipe ensuring that the sample is drawn from between the middle and the top third of the pipeline.

An optional Genie GPR probe regulator may be included. The function of this probe is to ensure a clean dry sample to the analyzer and to reduce the pressure of the sample. The lower pressure will improve the response time of the analyzer. For installation instructions, refer to associated documents. Do not install the Genie probe regulator on a vertical pipe.

First Stage Pressure Reduction and JT Cooling Effect:

First stage pressure regulation is ideally done at the sample point with careful consideration given to the Joule Thompson Cooling Effect (JT Effect). The JT effect is loosely defined as the cooling effect on gases as a result of pressure reduction. A general rule of thumb to determine JT effect estimates a 7 °F cooling effect for every 100 psig of pressure reduction.

JT = Pressure Reduction/100 x 7 °F

Example: Joules Thompson Effect

- Line Conditions
  - Pressure = 510 psig
  - Gas Temp= 70°F
  - Ambient Temp= 50°F

- Calculate Joules Thompson Cooling Effect:

  If the first stage pressure reduction takes line pressure of 510 psig to 10 psig the cooling effect from first stage pressure reduction is:

  (510-10)/100 x 7 = 35°F

  So the gas is cooled by 35 °F as a result of Joules Thompson Effect.

- Calculate the Gas Temp:

  If the initial Gas Temp is 70°F and the Joules Thompson Cooling Effect is 35°F then:

  70°F - 35°F = 35°F

  So the Gas Temp traveling in the sample transport line to the analyzer Sample Conditioning System is 35°F after first stage pressure reduction.

There may be some recovery or further temperature reductions as a result of ambient temperature effects on the sample transport tubing and internal gas temperature, but the potential for 2 phases (C6+ condensation) is greatest at the coldest point.

It is critical to preserve the composition of the gas, so it is important to consider the detrimental effects that the Joules-Thompson effect may have on the sample. The sample temperature must be maintained above the hydrocarbon dew point to prevent high BTU components to drop out (liquefy) prior to analysis causing large errors in measurement.

The hydrocarbon dew point is the temperature (at a given pressure) at which the hydrocarbon components of any hydrocarbon-rich gas mixture, such as natural gas, will start to condense out of the vapor phase.

Sample Volume and Flow Rate:

Sample should be supplied to the TFS1-Ex analyzer sample conditioning system (SCS) at 50-250 psig for each stream. For lean gas (BTU of 1050 or less and relative density of 0.6 or less), with pressure drops from line conditions of 500 psig or less and ambient temperature of 32 °F (0 C), this pressure can be reduced in one cut at the sample point-- ideally with 10-15 psig at the input of the conditioning system panel (SCS) with a second and final pressure regulator.

The sample should be supplied to the TFS1-Ex analyzer at 10-15 psig and at a flow between 300-500 cc/min. A bypass sweep is recommended to reduce sample lag time in the sample line if it is at high pressure or it is longer than 15 feet. The standard sample tubing material is 1/4" 316 stainless steel; however, 1/8" stainless steel tubing can be used if the response time is critical. Carbon steel sample line and/or fittings are not acceptable.

Table 2: Sample Lag Time vs. Tubing Size

Tube Size (“)	Tube Gauge	ID (“)	ID (cm)	Flow (SCFH)	Flow Std. (cc/min)	Pressure (PSIA)	Lag Time per 100’ (min)	Lag Time per 100’ (sec)
3/8	20	0.319	0.810	5	2359	800	36.30	2178
3/8	20	0.319	0.810	5	2359	200	9.07	544
3/8	20	0.319	0.810	5	2359	50	2.27	136
1/4	20	0.181	0.459	5	2359	800	11.69	701
1/4	20	0.181	0.459	5	2359	200	2.92	175
1/4	20	0.181	0.459	5	2359	50	0.73	44
1/8	20	0.081	0.205	5	2359	800	2.34	140
1/8	20	0.081	0.205	5	2359	200	0.59	35
1/8	20	0.081	0.205	5	2359	50	0.15	9

Sample Conditioning System (SCS):

The purpose of the SCS is to receive the sample from the sample transport system after first stage pressure regulation and to perform the following functions:

Isolation from line conditions and the sample transport system. Block valves on each stream
Provide clean and dry Sample Sample filtration and sample bypass
Control Pressure Second stage sample pressure regulation Third stage carrier pressure regulation
Preserve the composition of the Gas Heat traced sample transport or integral heated SCS to prevent heavier components from liquefying
Stream selection (in multi-stream applications)
Sample flow control and indication
Sample rotometer mounted after all stream switching

Figure 1: Typical TFS1-Ex SCS

Customer Connections:

Unpack the analyzer and check for damage.
Ensure that the analyzer power supply and range are suitable for the application.
Check that the hazardous location rating is suitable for the installation location.
Select an installation location that is close to the sample point.

- Ensure that the selected installation site provides adequate room for maintenance and repair

Bolt the analyzer to the wall to a solid surface.

Note: 3/8″ x 1″ bolts are recommended for installation

Wire power, analog outputs, discrete inputs & outputs and communications to the TFS1-Ex Analyzer.

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

CAUTION: TFS1-Ex, Seals Not Poured. Pour seals before energizing the circuit (see APPENDIX B)

Tube the sample inlet(s), calibration inlet, sample sweep(s) and sample vent.

- 1/4″ 316 stainless steel tubing is recommended for the sample tubing
- 1/8″ 316 stainless steel tubing can also be used if the response time of the analyzer is of particular concern
- All fittings in the sample and vent lines must be 316 stainless steel
- The vent line should be tubed in 3/8″ stainless steel tubing to a maximum of 6′ (1.83 m)
- 1/2″ 316 stainless steel tubing should be used for vent lines exceeding 6′ (1.83 m)

CAUTION: Before resuming line pressure, be sure that all port connections, sample sweep, and sample conditioning system are securely installed.

1. Turn on sample pressure, ensure sweep is slightly open and set pressure to 15 psig.
   α. Perform a Leak Test

CAUTION: All connections must be LEAKTIGHT to insure the effectiveness of the analyzer as well as SAFETY.

The user, through their own analysis and testing, is solely responsible for the product selection and ensuring all responsibility, safety and warning requirements of the application are met. If the equipment is used in a manner not specified by Envent Engineering Ltd., the protection provided by the equipment may be impaired.

CAUTION: This unit requires a disconnect device rated 24 VDC and 5A max, must be protected by a circuit breaker rated 24 VDC and 5 A max, and is to be installed in accordance with local electrical codes.

CAUTION: Turn off power before servicing. Ensure breakers are off before connecting or disconnecting supply power.

All customer connections are indicated on the circuit board.

Note: The 4-20 mA output requires 12 to 24 VDC loop power.

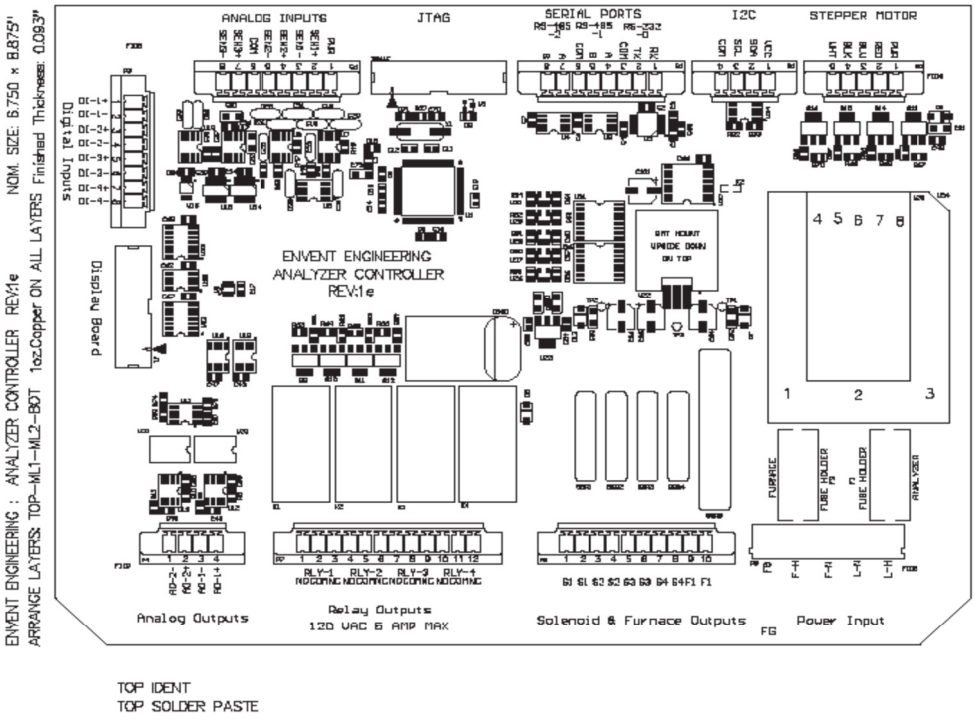


Figure 2: Controller Board Layout & Power Input

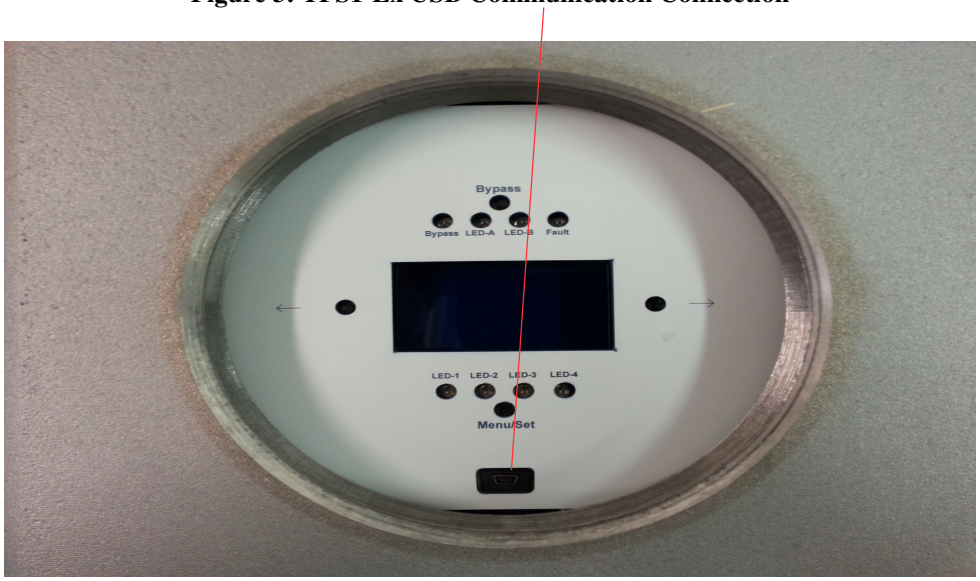
Table 3: Customer Connection Summary (See Figure Above)

Application	Positive	Negative/Neutral	Ground
AC	L-H & F-H hot	L-N & F-N neutral	FG
DC	L-H & F-H +	L-N & F-N -	N/A

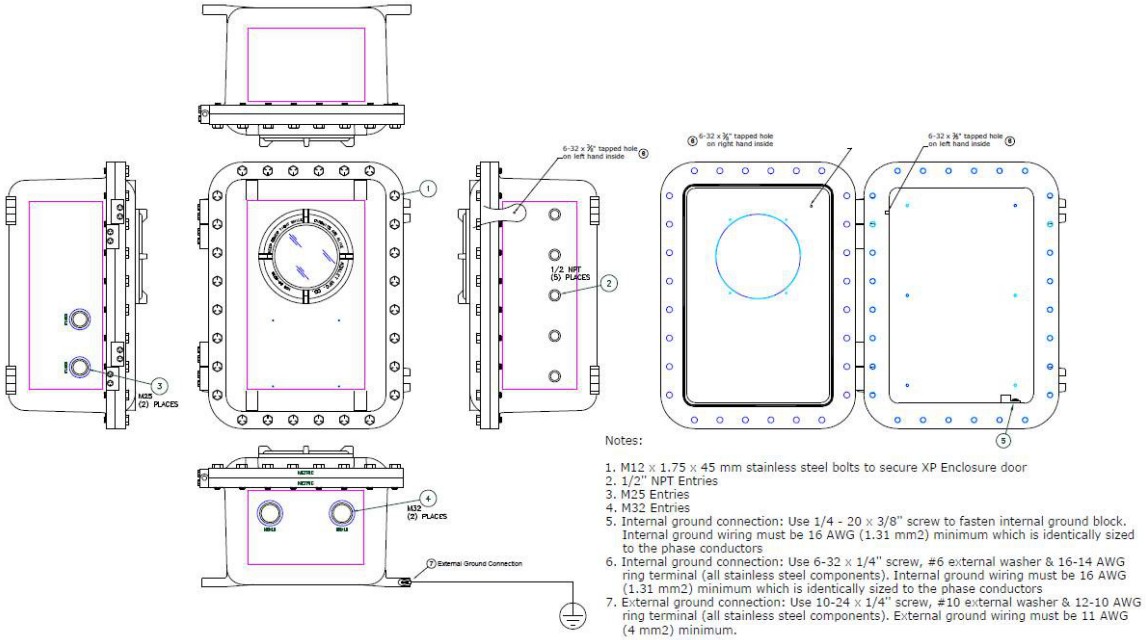
Serial Communication:

In order to communicate with a TFS1-Ex, plug into the USB port located just behind the window.

Figure 3: TFS1-Ex USB Communication Connection

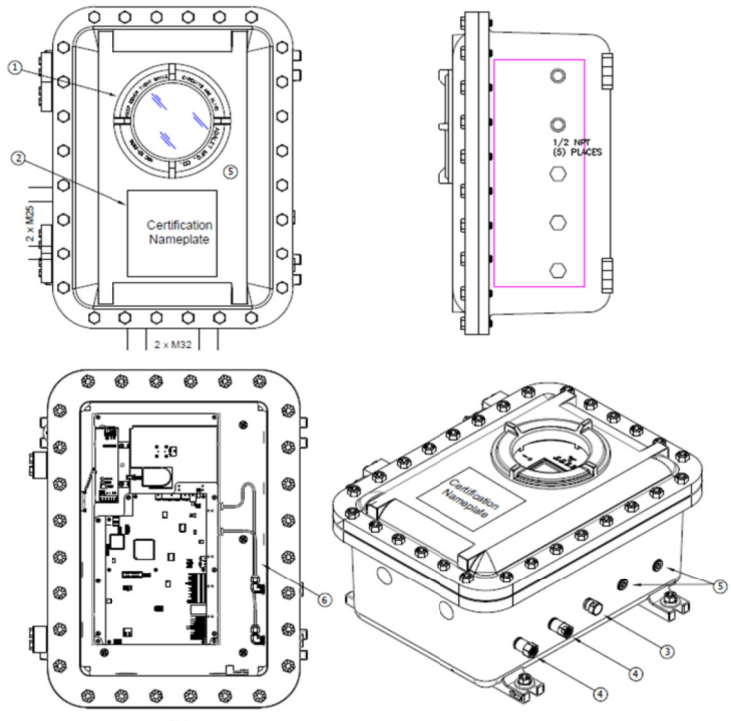


Enclosure Entries & Internal/External Ground Connection:



Notes:

1. M12 x 1.75 x 45 mm stainless steel bolts to secure XP Enclosure door
2. 1/2" NPT Entries
3. M25 Entries
4. M32 Entries
5. Internal ground connection: Use 1/4 - 20 x 3/8" screw to fasten internal ground block. Internal ground wiring must be 16 AWG (1.31 mm2) minimum which is identically sized to the phase conductors
6. Internal ground connection: Use 6-32 x 1/4" screw, #6 external washer & 16-14 AWG ring terminal (all stainless steel components). Internal ground wiring must be 16 AWG (1.31 mm2) minimum which is identically sized to the phase conductors
7. External ground connection: Use 10-24 x 1/4" screw, #10 external washer & 12-10 AWG ring terminal (all stainless steel components). External ground wiring must be 11 AWG (4 mm2) minimum.



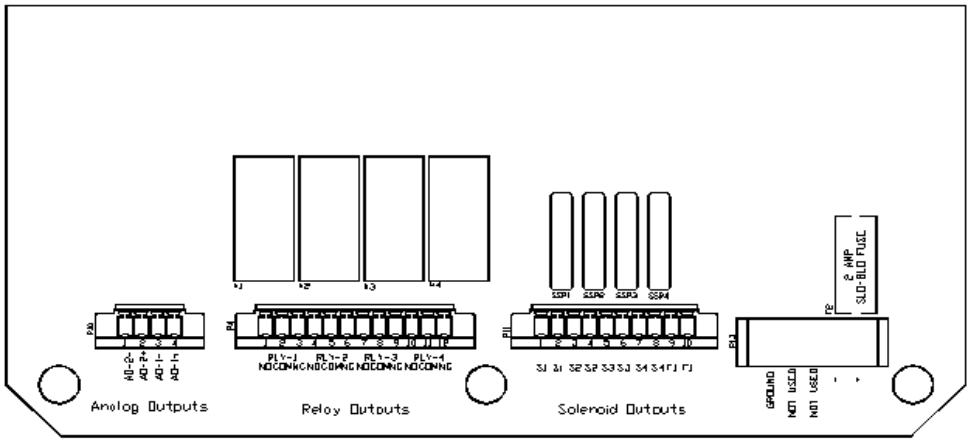
Notes:

1. XP TFS1-Ex Enclosure cover window is secured with 6-32 x 3/4" set screw.
2. ATEX-IEC Certification Nameplate Location.
3. HLS Bd. 1/2.S.N. Breather Drain (location may vary). Breather Drain must always be installed and wrench tight.
4. Killark KB1FA25 SS6 or Officine Meccaniche FT-61090-8 Flame Arrestors (location may vary). External Process piping thread size of 1/4 NPT
5. 1/2 NPT Plugs Killark D5.1/2.S
6. Internal Tubing.
7. XP TFS1-Ex Enclosure free volume: 24.5L.

Figure 4: Enclosure Entries & Internal/External Ground Connections

Relay Outputs and Solenoid Driver:

Four relays are provided as status outputs, to drive external relays or solenoids. Envent recommends use of the solenoid drivers for external loads. DO NOT supply external power to solenoid drivers.
Four solenoid drivers provided to directly drive solenoids for shutdown, auto-calibration or stream switching.
Unless otherwise specified the solenoid driver output is 24VDC.



4-20 ANALOG OUTPUT-1
4-20 ANALOG OUTPUT-2
NOTE: ANALOG OUTPUT 2 REQUIRES LOOP POWER

SOLENOID-1 SPARE
SOLENOID-2 SPARE
SOLENOID-3 SPARE
SOLENOID-4 SPARE
NOTE: SOLENOID OUTPUTS SUPPLY POWER TO THE LOAD

RELAY-1
RELAY-2
RELAY-3
RELAY-4 FAULT
NOTE: RELAY OUTPUTS ARE DRY CONTACT

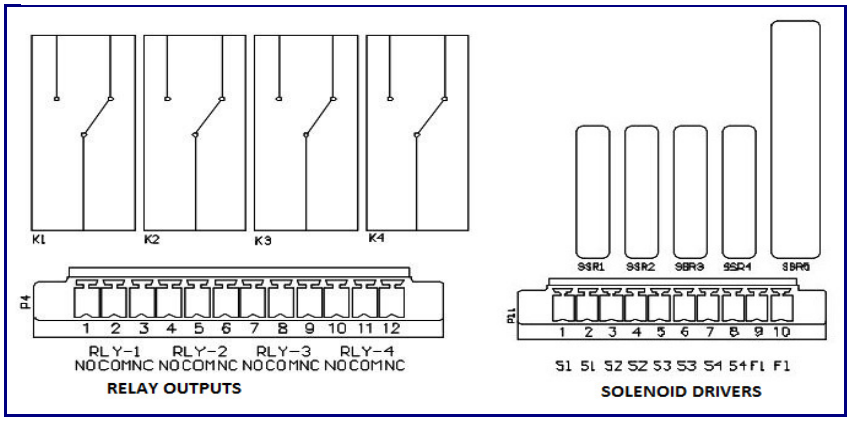


Figure 5: Relay Outputs & Solenoid Drivers

TFS1-Ex Analyzer Start-up and Operation:

The purpose of this procedure is to verify span accuracy upon installation of the TFS1-Ex Analyzer. This procedure is also performed at periodic intervals throughout the effective life of the analyzer. This procedure has three parts: Warm-up, Zeroing, and Span Verification. Zeroing is a measurement on a zero (inert) gas. Span verification is a measurement on the customer's trusted certified mixture(s).

WARNING: DO NOT ZERO THE ANALYZER WITH SPAN CALIBRATION GAS: USE NITROGEN or INSTRUMENT AIR ONLY

TFS1-Ex Analyzer Warm-up:

After the TFS1-Ex analyzer is powered on it requires a twenty min warm-up period. During this time the display will show 100 Src% as well as any local alarms. These local alarms may include if so equipped, Lo Temp, Lo Src% Com Fail, Status and Lo Pressure.

TFS1-Ex DOES NOT REPORT PROCESS DATA DURING WARM-UP PERIOD.

During TFS1-Ex warm-up the operator should take note of the Cell Temperature. Using Men/Scroll button to scroll to Cell Temp on the TFS1-Ex Display. Once the Cell Temperature reaches 60C the TFS1-Ex analyzer is now ready for the zero procedure.

THE TFS1-Ex ANALYZER CELL TEMPERATURE MUST BE AT ~60C FOR MEASUREMENT OF CALIBRATION OR PROCESS GAS. THIS IS SHOWN ON THE ANALYZER DISPLAY

Zeroing Procedure:

Before Starting the Zeroing Procedure the analyzer should be purged for 1hr with Nitrogen or Instrument air. If the analyzer is being used to sample Acid Gas the analyzer must be purged for 12hrs to pickle down H2S in TFS1-Ex Sensor Cell

The TFS1-Ex analyzer should be zeroed before measurement of process gas. The zeroing requires either Nitrogen or ***CLEAN*** instrument air. This TFS1-Ex function can be initiated by the operator on the local TFS1-Ex display using the MENU/Scroll and LEFT OR RIGHT push buttons. If TFS1-Ex use the magnetic wand to operate the display cursor.

The operator should take note of the sample system operation before zeroing:

1. Turn the "Sample Inlet" valve 90 degrees on the SCS to stop the flow of process gas.
2. Source a cylinder of Nitrogen gas or Clean instrument air.
3. Connect appropriate pressure regulator to nitrogen cylinder.
4. Connect length of tubing from pressure regulator to the 3-way valve "Calibration Inlet" port on the TFS1-Ex Analyzer SCS.

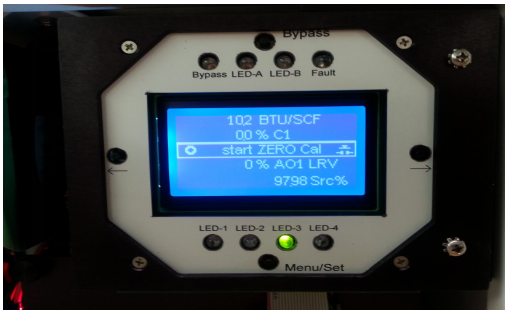
Note: The "Calibration Inlet" port fitting can allow for 1/8 or 1/4 connection.

5. Turn the 3-way "Calibration Inlet/Process Gas valve 180 degrees towards the "Calibration Inlet" port. This will allow calibration gas to flow to the TFS1-Ex Analyzer.
6. Open the calibration cylinder main valve and set the pressure regulator to 15psi.
7. Set the TFS1-Ex Analyzer flow meter to 4.0
8. The operator will then proceed to the local interface display to execute the Zero Calibration

Figure 6 shows the menu screen displaying the "start zero" Command prompt:

Using the Menu/Set push button scroll the display until the start ZERO Cal is within the box shown in Figure 6

Figure 6: start Zero Cal Command



TFS1-Ex Analyzer in Zero Cal Mode with LED-3 Illuminated

By pressing either the left or right push buttons the TFS1-Ex Zeroing will start. There will be a two minute purge time followed by LED# 3 on the lower part of the display lamacoid illuminating green. This indicates that the TFS1-Ex Zero Cal has started and will not be completed until the LED - 3 is not lit. The TFS1-Ex will return to LED-1 which is the Process Stream when the Zero Cal is completed. The component zero specification is up to (+0.03) This is baseline noise.

The time to complete the TFS1-Ex Zero Cal will depend on the TFS1-Ex Analyzer analysis time. By default Zero Cal is done for five runs multiplied by the analysis time which is typically 60s or down to 10s

Once the LED-3 has gone out wait for 2 min before applying span gas or resuming process gas. This is to allow the Precisive sensor to finish its zeroing and adjust its baseline.

Span Verification:

Due to the variety of sample system conditions and to ensure proper span verification gas is being used it is recommended to consult the factory for support for this procedure.

Ensure a suitable calibration gas and a clean stainless steel regulator with the correct CGA fitting is available. Check that the regulator is rated for calibration cylinder pressure.

- Check the expiry date on the calibration gas bottle before using
- The recommended calibration gas supplier is Air gas or Air Liquide

Note: the following instructions apply to analyzers with standard sample systems; however, the basic principles still apply.

Turn off sample gas flow using the 3-way "Calibration In" valve

1. Connect Span calibration gas bottle to the "Calibration In" valve
2. Set the calibration gas pressure to 15 psig and the flow meter to 4.0
3. Allow the analyzer reading to stabilize (10 to 15 minutes)
4. Verify the reading on the display. They should match the calibration gas concentration(s)
5. Turn on sample gas flow using the 3-way "Calibration In" valve
6. Set the sample gas pressure to 15 psig and the flow meter to 4.0

LCD Keypad Display:

CAUTION: The glass window on the TFS1-Ex must remain installed in order to ensure area classification is maintained

To configure the TFS1-Ex, if the area is non-hazardous, the window can be removed for basic TFS1-Ex operations available from the internal buttons or USB communication for complete TFS1-Ex operations available through ICE.

Basic TFS1-Ex operations are configured by using the push-buttons as shown below.

Figure 7: TFS1-Ex Standard Operator Interface

Table 4: Analyzer Display-button functions

Button	Description/Function
Bypass	Used to inhibit all analyzer alarms to a non-alarm state, and sets the analog 4-20 mA output to 2 mA. The Bypass LED illuminates when Bypass mode is enabled.
Scroll Right [→]	Used to move the cursor to the right. Also used to SAVE configuration adjustments.
Scroll Left [←]	Used to move the cursor to the left. Also used to CANCEL configuration adjustments.
Menu/Set	Used to cycle through the menu options. Also used to increase numerical values when making configuration adjustments

Maintenance

Recommended Maintenance Schedule:

The TFS1-Ex Analyzer is designed to be maintenance free for extended periods of time. Regular check-ups will ensure that the analyzer is operating to specifications.

Recommended maintenance and operation verification of the analyzer consists of:

- Filter replacement (weekly to monthly depending on quality of sample gas)
- Re-zeroing should be done every three months with Nitrogen or clean instrument air
- Span Verification should be done yearly Spec is +/- 0.2% of full scale on all readings
- Light source replacement is required when the Lo Src% Alarm is indicating which means the source is below 40% output. This is a reminder that the source will need to be changed soon but not immediately.

Filter Replacement Procedure

It is recommended to replace the filter element when the pressure drop reaches 10 psig across the filter.

Shut off the line pressure before changing elements. Ensure there is no pressure in the filter housing.
Remove the bowl, element retainer and filter element. Replace Filter element with Bonded Microfibre Coalescing Filter Element
Tightening the element retainer a ¼ to 1 turn after it first contacts the filter element securely seals the filter tube. The amount will depend on the housing type and element size. A mark on the end of the retainer can be used as a guide.
Before replacing the housing bowl ensure that the mating threads and sealing surfaces are clean and damage free. It is recommended that the threads and sealing faces be lubricated with a small amount of silicone grease before assembly. Stainless steel housings fitting with a solid PTFE gasket the bowl should be tightened to a torque of between 30Nm and 40 Nm.
Before resuming line pressure be sure that all the port connections, the drain plug, and the housing bowl are securely installed. All connections must be LEAKTIGHT to insure effective filtration as well as SAFETY.

Fuse Replacement

- Insert new fuse in fuse holder cover
- Place fuse and cover into fuse holder body
- Install wire tie under fuse holder body and over fuse Fuse holder cover
- Tighten wire tie to prevent unintentional fuse removal

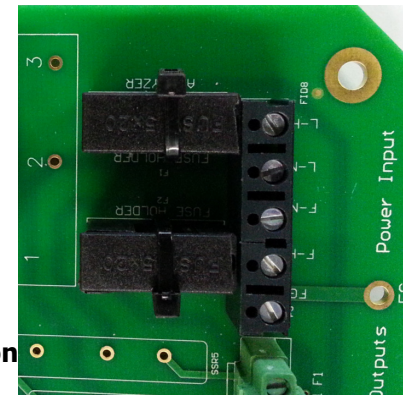


Figure 8: Fuse Installation

Sample Conditioning System Cleaning Procedure:

During start-up or plant upset situations, the TFS1-Ex analyzer may become contaminated with amine or hydrogen sulfide scavenger solution. This may cause the analyzer to read low (this can be determined at calibration). If the analyzer reads low, it will require incremental increases in the gain to maintain calibration. Please refer to factory calibration sheet for factory set gain factor. The scavenger solution is water soluble and therefore is relatively easy to clean.

Material List: Cleaning kit part number: 330900

- Alconox Laboratory cleaner or equivalent residue free cleaning agent
- Fresh water
- 100% Isopropyl Alcohol
- Large bucket to mix cleaning solution
- Rinse bottle

CAUTION: Do not use solvents, brake cleaner, soaps or detergents.

Procedure

1. Mix a 1% (2-1/2 tbsp per gallon) of Alconox in warm water
2. Sample line tubing
    A. Shut off flow at the sample point prior to sample conditioning system
    B. Flush the sample line and components with cleaning solution
    C. Rinse with fresh water
    D. Flush with isopropyl alcohol
    E. Dry with clean, dry instrument air or gas
3. Sample conditioning system

CAUTION: Dis-assembly of the pressure regulator and solenoids in the field is not advised. Consult the factory if the regulator or solenoid appears contaminated.

Remove filter elements from filter housings and discard

A. Remove all sample conditioning system components and soak in cleaning solution
B. Ensure valves are fully open when cleaning
C. Flush sample components with fresh water
D. Rinse with isopropyl alcohol
E. Blow dry with clean compressed air or fuel gas
F. If the any clear (Tygon) tubing appears discolored, replace the tubing
G. Tubing on humidifier should be replaced if it appears contaminated

4. Re-assemble Stainless Steel Tubing to analyzer according to analyzer drawing
5. Once sample conditioning system has been re-assembled ensure accurate readings from dis

Gas Cell Purge and Flush:

NOTE: Please Contact Envent Engineering Before Dis-assembly and Cleaning for Service Support to ensure sensor integrity is maintained

Contaminated gas cell windows may be cleaned by flushing the gas cell with Isopropyl Alcohol (IPA) solution to remove the particulates or contaminants that may be stuck on the windows. This procedure does not require any hardware dis-assembly.

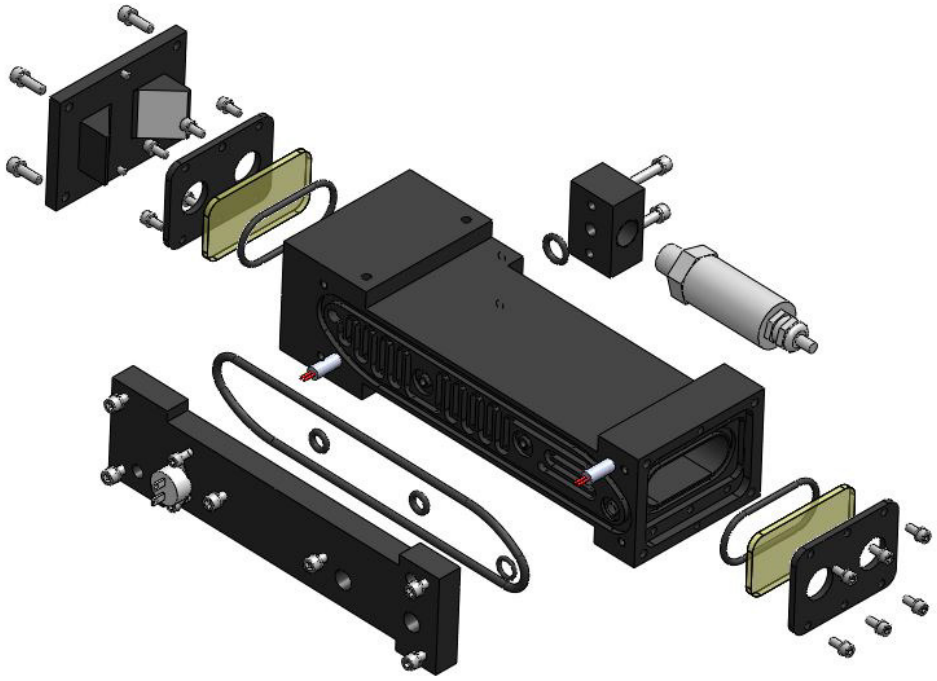
Tools and Materials

The following tools and materials are required and/or recommended:

- Isopropyl alcohol (IPA) solution (99% purity or better)
- Tubing set with ¼" compression fittings (fluid source and drain)
- Liquid pump (or other means to force flow the liquid through the gas cell)
- Pressurized dry nitrogen

Procedure

1. Turn off all gas supply lines and turn off power to the analyzer before performing any service procedure
2. Prepare and connect IPA tubings to the analyzer
   a) Connect the IPA source tubing to the exhaust port (note the "reverse" connection)
   b) Connect the IPA drain tubing to the inlet port (note the "reverse" connection)
3. Pump the IPA solution into the exhaust port of the analyzer (means to pump liquid is at the discretion of the operator)
   a) Fluid flow shall not exceed 20 L/min, and pressure shall not exceed 30 psig.
   b) Flow duration is determined by the severity of the contamination (at operator's discretion)
   c) Procedure
4. Completely drain all liquid.
5. Connect dry nitrogen to the analyzer. Note that the source shall be connected to the exhaust port, and the exhaust be connected to the inlet port.
6. Flow dry nitrogen at 10 – 20 L/min at around 1 atmospheric pressure
7. Power on the analyzer
8. Continue nitrogen flow for approximately 30 minutes while the analyzer is powered on and until the gas cell temperature reaches the nominal value (60$_0$C for most analyzer versions)
9. Reduce the nitrogen flow rate to 0.1 – 1 L/min
10. Monitor "dryness" of the gas cell – the reported concentration values may be used to gauge whether the gas cell has dried out. Values close to or at zero indicate that gas cell has returned to its "dry" state.
11. Verify that the light intensity has come back to its normal value. The procedure may be repeated if needed.



Gas Cell Dis-assembly Exploded View

APPENDIX A: Recommended Spare Parts List

Part Number	Part Description
100040	Sample flow meter 0-600 cc/min
F-00002	Fuse
330407	Coalescing Filter Element
800801	Gas Cell Window and Gaskets
800800	Light Source Assembly

APPENDIX B: Sealing Compound For Sealing Fittings in Hazardous Locations

Componente A – Component A

Indicazioni di pericolo/*Hazard statements*

Nessuna/*none*

Consigli di prudenza/*Precautionary statements*

Nessuno/*none*

Componente B – *Component B*

GHS08 GHS07

Pericolo
Danger

Componenti pericolosi:

- Difenilmetanodiisocianato, isomeri e omologhi
- Formaldeide, prodotti di reazione oligomerica con anilina e fosgene

Hazardous components:

- Diphenyl methane diisocyanate, isomers and homologues
- Formaldehyde, oligomeric reaction products with aniline and phosgene

Indicazioni di pericolo/*Hazard statements*

H315 Provoca irritazione cutanea.
H317 Può provocare una reazione allergica cutanea.
H319 Provoca grave irritazione oculare.
H332 Nocivo se inalato.
H334 Può provocare sintomi allergici o asmatici o difficoltà respiratorie se inalato.
H335 Può irritare le vie respiratorie.
H351 Sospettato di provocare il cancro.
H373 Può provocare danni agli organi (Organi del respiro) in caso di esposizione prolungata o ripetuta se inalato.

H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.
H332 Harmful if inhaled.
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335 May cause respiratory irritation.
H351 Suspected of causing cancer.
H373 May cause damage to organs (Respiratory organs) through prolonged or repeated exposure if inhaled.

Consigli di prudenza/*Precautionary statements*

P260 Non respirare polvere/ fumi/ gas/ nebbia/ vapori/ nebulizzato.
P280 Indossare guanti protettivi/Proteggere gli occhi/il viso.
P302 + P352 IN CASO DI CONTATTO CON LA PELLE: lavare abbondantemente con acqua e sapone.
P304 + P340 IN CASO DI INALAZIONE: trasportare l'infortunato all'aria aperta e mantenerlo a riposo in posizione che favorisca la respirazione.
P305 + P351 + P338 IN CASO DI CONTATTO CON GLI OCCHI: sciacquare accuratamente per parecchi minuti. Togliere le eventuali lenti a contatto se è agevole farlo. Continuare a sciacquare.
P308 + P313 IN CASO di esposizione o di possibile esposizione, consultare un medico.

P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P280 Wear protective gloves/eye protection/face protection.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.

VEDERE SCHEDA DI SICUREZZA – *SEE SAFETY DATA SHEET*

Produttore: WEVO-CHEMIE GmbH Germany
e-mail: msds@wevo-chemie.de
In caso di emergenza:
telefono: +49 711-16761-0

Manufactured by: WEVO-CHEMIE GmbH Germany
e-mail msds@wevo-chemie.de
In case of emergency:
phone: +49 711-16761-0

Revisione del __ giugno 2014

PREPARAZIONE RESINA / RESIN PREPARATION

CARATTERISTICHE
Resina poliuretanica bicomponente di colore nero (dopo la miscelazione dei due componenti).
Tempo di polimerizzazione ~10 ore (temp. amb.)
Codice = CRV420

RESINA (Componente A)
- composto di colore nero
- codice = CRV420H71 (PU552FL)
- rapporto di miscelazione in peso: 100 parti

CATALIZZATORE (Componente B)
- composto di colore marroncino
- codice = CRV420H72 (Wevonat 300)
- rapporto di miscelazione in peso: 20 parti

Attenzione:
Conservare in luogo secco ed a temp. >10°

RAPPORTO COMPOSTI DA MISCELARE
Rapporto 100 g (composto A) e 20 g (composto B) al momento dell'utilizzo

CONFEZIONI DISPONIBILI
vedere tabella 1 pag. 5 delle istruzioni dei raccordi di bloccaggio EYS-EZS

PREPARAZIONE DEL COMPOSTO (MISCELAZIONE COMPONENTE A CON B)

Per utilizzo totale

a) Mescolare il componente A fino ad ottenere un composto omogeneo e liquido eliminando eventuali sedimentazioni o depositi
b) Aggiungere l'intero contenuto del componente B
c) Mescolare il composto fino a renderlo omogeneo
d) Colare il composto nel raccordo precedentemente preparato (vedere Tabella A pag. 5 delle istruzioni dei raccordi di bloccaggio EYS-EZS)

Per utilizzo parziale

a) Versare una parte del componente A in un contenitore metallico o plastico privo di impurità
b) Aggiungere il componente B, mantenendo sempre il rapporto di miscelazione in peso o percentuale
c) Mescolare il composto fino a renderlo omogeneo
d) Colare il composto nel raccordo precedentemente preparato (vedere esempio come sopra)

TEMPO DI UTILIZZO DEL COMPOSTO MISCELATO
(per 100 g di composto miscelato)

Temp. amb. °C	Tempo utilizzo dopo miscel.
20	35 min
15	45 min

Quantità diverse: <100 g = aumento tempo utilizzo
>100 g = riduzione tempo utilizzo

PER APPLICAZIONI PARTICOLARI CONSULTARE IL NOSTRO UFFICIO TECNICO

Produttore: WEVO-CHEMIE GmbH Germany

CHARACTERISTICS
Two-components, polyurethane black resin (after mixing the two components).
Polymerization time ~10 hours (room temp.).
Code = CRV420

RESIN (Component A)
- black compound
- code = CRV420H71 (PU552FL)
- mixing ratio by weight: 100 parts

CATHALIZING AGENT (Component B)
- brown compound
- code = CRV420H72 (Wevonat 300)
- mixing ratio by weight: 20 parts

Warning:
Store in dry conditions at temp. >10°C.

RATIO OF COMPOUNDS TO BE MIXED
Ratio 100 g (compound A) with 20 g (compound B) when ready to be used

AVAILABLE PACKAGES
See table 1 page 5 of sealing fittings series EYS-EZS instructions

PREPARATION OF THE COMPOUND (MIXING COMPONENT A WITH COMPONENT B)

For a complete usage

a) Mix component A for as much as to obtain a liquid, homogeneous compound and get rid of possible solid bits or remains
b) Add on the whole content of component B
c) Stirr the compound for as much as to obtain a homogeneous substance
d) Let the substance glue into the previously prepared connection (see Table A of sealing fittings series EYS-EZS instructions)

For a partial usage

a) Pour part of component A into a metallic or plastic container free of impurities
b) Add on the component B, by always keeping the correct mixing ratio of weight or percentage
c) Stirr the compound for as much as to make it homogeneous
d) Let the substance glue down on the previously prepared connection (see example as above)

TIME OF USE FOR THE MIXED UP COMPOUND
(for 100 g of the mixed up compound)

Room temp. °C	*Time of use after mixing*
20	*35 min*
15	*45 min*

Different amounts: <100 g = increase of time of use
>100 g = reduction of time of use

FOR SPECIAL APPLICATIONS PLEASE CONTACT OUR TECHNICAL DEPT

Manufactured by: WEVO-CHEMIE GmbH Germany

This document has been continuously improved and revised over time; see the table below for revision (rev) information.

Rev No.	***Rev Date***	***Rev Description***
0	15 Nov 2016	Initial Release
1	24 May 2019	Updated Envent's Address

Decimal increases on revision numbers (E.g. Rev 1.0 to Rev 1.1) on this user manual means that content changes will not affect or contradict ATEX-IEC certification documentation, thus the notified body does not need to be informed of the changes; for instance, improving writing, layout. A full unit change (E.g. Rev 1.0 to Rev 2.0) will mean that the content changes have been communicated and updated to the notified body.

For further information, or a copy of our most recent operating manual, please visit us at www.envent-eng.com. Envent Engineering Ltd. reserves the right to change product design and specifications at any time without prior notice