

# **TERRASYSTEM®**

**NANO - TECHNOLOGIE**

**Years of Experience**

**For The Future**



# Contents

General Information

Application & Benefits

Questions & Answers

References

Contact

# General Information

**TERRA-3000®** is a liquid, water-soluble ion exchanger .

**TERRA-3000®** works as a catalyst on surfaces. When applied correctly, it changes the chemical and physical properties of the surface in such a way that the ground attains a better strength and density than would be possible from its nature alone. This comes about by continuously changing the water-binding power of soil particles (or 'colloids'). As a result, capillary action is almost complete broken down.

**TERRA-3000®** is not an aggregate or binding material like cement or lime, asphalt or salt. Instead, it need only be present in the soil to provide a more compact bedding and almost entirely prevent subsequent swelling. Moisture and frost have no effect on this.

Since **TERRA-3000®** works as a catalyst, it also cannot be washed out.

Which surfaces are suitable/unsuitable?

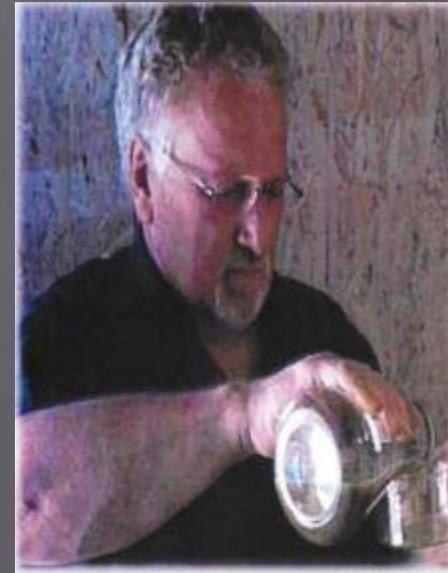
**TERRA-3000®** is suitable for all surfaces which have an ultra-fine constituent rate under 0.002 mm (clay) of at least 15%

Unsuitable surfaces include all pure sand-, marsh- or humus soils with an ignition loss greater than 4%.

**How is TERRA-3000® applied?**

It is essential that all soil particles (colloids) come into contact with the **TERRA-3000®** active agent.

The effect is only noticeable after the surface has been optimally compacted.



# Application & Benefits



# Benefits of **TERRA-3000®**

1. Time savings of up to 50% during construction
2. Construction materials - savings of up to 50% on conventional materials
3. Up to 50% less transport capacity required (for transporting materials)
4. Financial savings of up to 50%
5. No need for subsequent repair work
6. Roads built using **TERRA-3000®** have more than twice the load bearing capacity of that required for conventional roads.
7. Savings of up to 50% on cover strength for sub-soils treated with **TERRA-3000®**.
8. Roads constructed with **TERRA-3000®** become firmer from year to year.
9. **TERRA-3000®** roads or squares cannot be destroyed by water or frost.
10. **TERRA-3000®** is environmentally friendly- it does not cause damage to the ground water.



# TERRA-3000® Application

## Preparation:

- Remove vegetation and the humus layer.
- Lay coarse sub-grade to the required height.

Using a suitable machine, decompact the ground until it is able to absorb water and the working solution (water with **TERRA-3000®** can penetrate immediately.

A surface which is too firm would also hinder subsequent work with the rotary tiller.



The rotary tiller must be employed after each application of the working solution (30cm in depth). Stony surfaces may also require use of a (disc) harrow. Please note that work is carried out over several stages in order to allow **TERRA-3000®** to become thoroughly mixed in the ground. The natural moisture level of the soil must be monitored continuously and it must have the optimal moisture level based on the findings of a Proctor test. Add more water with **TERRA-3000®** where necessary. Optimal moisture content is also very important when compacting the ground later. Working with a modern tiller, in which the correct dose of the working solution is introduced directly into the ground, precludes the use of a water truck and distributing pipe.

## Important:

Roads with heavy traffic must be constructed in two or three layers (coatings). Apply the same amount of **TERRA-3000®** for each layer. Repeat the **TERRA-3000®** application for each layer.



# TERRA-3000® Application

Which amount of **TERRA-3000®** ?

Admixing at optimal water content : 0,05 l **TERRA-3000®** per m<sup>2</sup> at a working depth of 30 cm will be mixed with water 1:20 – 1:40 reach optimum moisture (proctor-test).

The joint amount of **TERRA-3000®** and water brought in to the ground adapts

To the extrem deviation of natural water contents,

For example after strong precipitation or drought,

However the admixing of concentrated

**TERRA-3000®** will remain



# TERRA-3000® Application

- Apply **TERRA-3000®**, mix and compact optimally.
- Repeat procedure for each layer.  
The same applies for or with road aggregate.
- Next, lay the fine subgrade (motor grader)
- Optimally compact the ground.

In other words, the ground must be compacted when having an optimum moisture content. Carry out a Proctor test to determine the most favourable time to compact OMC (optimum Moisture content).

Using a roller, make sure the unladen weight is no less 15 tonnes.



# TERRA-3000® Application

## Caution:

First ensure that the surface has been sufficiently drained of surface water!

**TERRA-3000®** is not a miracle formula. In other words, it cannot be used to drain marshy ground. Drain off surface water via ditches or drains as in the traditional construction method.

## The result:

The treated ground is firm and frost-proof. There is usually no need to apply additional courses.



## Adding the cover:

When it rains, the surface treated with **TERRA-3000®** becomes slippery in the upper few millimetres. Therefore, it is essential to add a cover. Depending on how the treated surface is to be used, apply water-binding-, bituminous or other coating layers directly onto of the **TERRA-3000®** ground. When using cohesive overburden- pre-sieve material with a water bound cover, you must also of course Treat this material with **TERRA-3000®**. A water bound cover must have a minimum strength 2.5x that of the the strongest grain.

## Important:

**TERRA-3000®** is a material designed for underground usage. For this reason, always add a cover.



# TERRA-3000® Application

Important tests when using **TERRA-3000®** in construction

The following soil surveys are essential:

- A sieve analysis to determine the content of soil particles 0,002mm until 25mm.
- A hydrometer analysis to determine fine soil particles smaller 0,002mm = clay content
- Proctor test - to determine the ideal moisture for compaction.
- Plate loading tests - to test bearing capacity before adding cover and during compaction.



# Possible Applications

## **In forestry, agriculture and wine-growing**

Forest and hiking paths, agricultural roads and lanes, farm fortifications, floors for machine sheds, reinforcement of banks

## **In cities, communities, municipal projects**

Urban and rural streets and roads, pavements, camping-sites, tennis courts and other sports facilities, car parks, zoological parks, cemetery paths, barrages, motorways, sewage and pipeline ditches, leisure centres and cycle paths

## **In trade and industry**

Warehouses and plants, factory roads, car and lorry parks, private airports of all kinds, floors for indoor halls, refuelling parks and accesses for refineries.

## **In civil engineering/road construction**

Roads and squares of all kinds



# Possible Applications

## **Military applications**

Training areas, field airports, training areas for tanks, barracks, car parks, floors for indoor halls

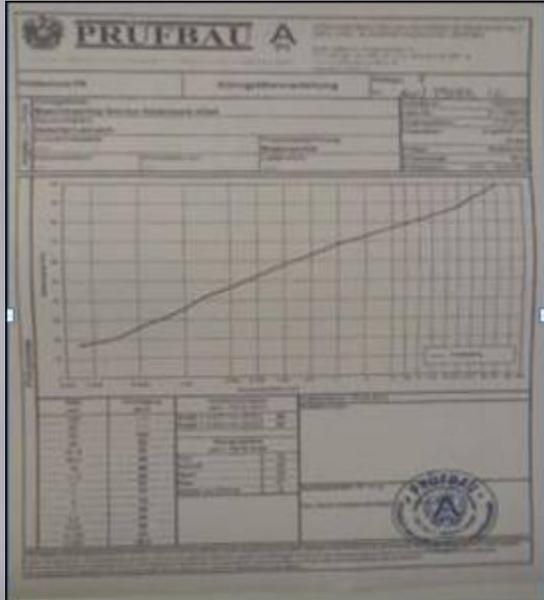
## **Additional applications**

Quarrying firms/gravel pits can use **TERRA-3000®** to turn their strong binding materials into a frozen-proof material ready for installation.

**TERRA-3000®** is also suitable for surfaces which need to be frozen-proof and withstand heavy loads.



# TERRA-3000® Working Procedure



## 1. Soil analysis

### Analysis

- Check your soil-structure with
  1. Sieve analyse : from 0,063mm – 25mm
  2. Hydrometer analyse : for the clay (<0,002mm) content
- The best structure is
  - 1/3 fines (< 0,063mm),
  - 1/3 sand (0,063mm until 2mm),
  - 1/3 gravel (2mm until 25mm)**Minimum 15 % clay (<0.002mm) must be in the soil.**
- Check the water sensibility, by you dry back to 50% of the optimum OMC-value, then you give the specimens for 2 days in the water (2 cm level).
- The sample is the reference (test score) of the project .
- There are some variations in the soil, so must make a new test.
- Check the load capacity (MN/m<sup>2</sup>) of the sub-grade.
- Ask for the load capacity of a finished road .



# TERRA-3000® Working Procedure



## 2. Apply TERRA-3000®

### Build in

- Pre mill resp. mix the missing fraction with a special stone milling machine.
- Yield from **TERRA-3000®** with special milling machine, insert **TERRA-3000®** so much water, to get the OMC-value, or a less more; to dry or wet ground can not compacted very well.
- Fabricate a formation level (planum) with a road grader.





# TERRA-3000® Working Procedure



## 4. Optimally compaction

### Compaction

- Only good compacted ground of 98% achieved AASHTO – spez.  
Gravity closed all capillaries and exalted the capacity.
- Use a gum wheel or sheep-foot roller .
- Finish the surface with a road grader and a barrel.



# TERRA-3000® Working Procedure



## 5. Top Layer

### Top layer

- After rolling (barrel) top layer twit.
- The top layer are can different material; bitumen, asphalt, concrete or only gravel.
- The surface must be clean (dust free), before get the top layer on it.



General Questions & Answers

concerning

**TERRA-3000®**

# General Questions about **TERRA-3000®**

## **What is different about the TERRA-3000® construction method in comparison with the conventional method?**

The only aspect which is different is the application of the **TERRA-3000®** solution (**TERRA-3000®** mixed with water). All other construction measures are the same as in conventional road construction and meet the 'Supplemental technical regulations for earth-moving and road construction, 1965' (ZTVE-STB 65).

## **Which soils are suitable for treatment with TERRA-3000®?**

Almost all soils are suitable. Exceptions include pure sand soils with less than a fine soil particle (0.002mm) content of less than 15%, and pure marshy ground which only contains humus. Other than these, all soils are suitable, the more binding, agrillaceous, and loamy, the easier it is to strengthen with **TERRA-3000®**. The more difficult it is to work the soil using conventional construction techniques, the more suitable the soil is for the **TERRA-3000®** method.

## **Why are soils limited to a fine soil particle content of 15%?**

The purpose of the **TERRA-3000®** construction method is to change the soil, to alter its water binding power (breakdown capillarity). If the solution adheres to soil particles (colloids), naturally, one needs to classify the surface in question according to these colloids. Of course one can also treat a soil which has a fine particle content less than 15%. In this case, this soil would be more frost-resistant but would not offer great savings compared with conventional construction methods. Conventional methods are not so costly for pure sand soils with a fine soil particle content less than 15% for example. Using **TERRA-3000®** on such soils would not offer such large savings compared with the conventional method. Instead, we only want to work with **TERRA-3000®** in cases where the customer can benefit from significant cost savings. Only in this way is the **TERRA-3000®** method justified.



# General Questions about **TERRA-3000®**

## **Does a surface treated with TERRA-3000® become firm by itself?**

No, it doesn't become firm by itself. Nevertheless: An optimum compacted **TERRA-3000®** surface will never lose firmness on account of water or frost. The effectiveness of **TERRA-3000®** in the soil only becomes apparent after compaction (rolling). Thus, it is the compactor and optimum compaction which are the most important elements of the whole **TERRA-3000®** construction method.

## **What loads can a path withstand after being repaired with TERRA-3000®?**

If it was optimally compacted, the path can withstand the heaviest loads. There are practically no limits.

## **Does a TERRA-3000® surface become less firm over time?**

No. Over time, the surface treated with **TERRA-3000®** actually becomes more and more firm, for a drying-out process and thus a higher firmness and finally a change to the soil, a form of silification, takes place.

## **What is the permanent load-bearing capacity of paths and streets which have been treated with TERRA-3000®?**

The load-bearing capacity of such paths and streets is unlimited.

## **What is the effect of existing stony material on a surface which is to be treated with TERRA-3000®?**

Any kind of stony material always has a favourable effect since it increases the firmness of the soil. Having said that, it is important when using the **TERRA-3000®** treatment, that we are not dependent on stony material.



# General Questions about **TERRA-3000®**

**How does **TERRA-3000®** behave with strongly binding loam and clay soils with a fine soil particle content under 0.6mm of 80-90%?**

As mentioned previously, the harder the loam or clay soil, the more fine soil particles (colloides) are contained in the soil, the easier it is to strengthen using **TERRA-3000®**. These difficult clay soils are as hard as concrete when dry, but soften and loosen up when it rains. This softening up does not take place in soils treated by **TERRA-3000®**, which have been optimally compacted.

**What happens to surfaces treated with **TERRA-3000®** during strong and heavy rainfall?**

If such surfaces treated with **TERRA-3000®** have not yet been rolled, the water will penetrate relatively deeply into the soil. **TERRA-3000®** has softened the soil. However, if the **TERRA-3000®** surface has already been optimally compacted, rain water or capillary water does not penetrate into this soil structure treated with **TERRA-3000®**, neither from above or below. Providing that our instructions have been followed correctly, heavy rainfall has no effect on soils treated with **TERRA-3000®**.

**What happens to paths, streets and squares treated with **TERRA-3000®** when heavy frost sets in?**

**TERRA-3000®**) largely deactivates the water-binding powers of the soil, and as good as breaks down the capillarity in the soil. As a result, capillary water cannot penetrate into the soil structure created with **TERRA-3000®**. Thus, if no water cannot be stored underneath a road built with **TERRA-3000®**, there is no way for frost to attack, and so no damage through thawing can arise (see guarantee conditions).



# General Questions about **TERRA-3000®**

## **What is the colour of a soil treated with TERRA-3000®?**

The soil retains its natural colour.

## **Can one use TERRA-3000® to repair roads damaged by frost?**

In principle, yes. One has to remove the destroyed cover, profile the substratum and work in **TERRA-3000®**. Next, the soil must be optimally compacted and afterwards, a cover is added again. This cover will never again be destroyed by water or frost, providing usage instructions have been followed correctly.

## **Does a frost-proof substratum need to be layed for TERRA-3000® roads?**

No. The soil treated with **TERRA-3000®** is the same as a completely frost-proof road substratum.



# General Questions about **TERRA-3000®**

## **How many years can a **TERRA-3000®**-treated road last for?**

One needs to draw the distinction here between the substratum and the cover. Any substratum treated with **TERRA-3000®** is robust and thus made-to-last. Only the cover will be subject to wear and tear in accordance with traffic levels.

## **What are the actual savings which can be made using the **TERRA-3000®** method?**

### **In principle, the following is no longer required when constructing with **TERRA-3000®****

The complete substratum of a road, path or square (comprising frost layer and sub-base). Using **TERRA-3000®**, at least 50% less cover strength is required, since a cover placed on an optimally compacted **TERRA-3000®** substratum can no longer be destroyed by frost or water.

Since the substratum is treated with **TERRA-3000®** and is not movable, all that is now required is a cover which functions purely as a seal and not one which has a supporting function.



# General Questions about **TERRA-3000®**

## **What is the % savings made through using the TERRA-3000® construction method?**

This depends on the properties of the soil, the geographical features in question and the current situation of the building market. The greatest savings which can be offered by the **TERRA-3000®** method are to be found where the toughest, strong binding soils tend to dominate.

Moreover, everywhere where extreme frosts are common, which this make conventional road construction very expensive. In such cases, the **TERRA-3000®** construction method results in a significantly lower cost of materials, labour and machinery.

## **How is the firmness of a TERRA-3000®-treated surface achieved?**

Soil firmness is achieved by means of optimum compacting using an oscillation roller or similar compaction machine. A soil treated with **TERRA-3000®** does not become firm by itself. Nevertheless: An optimum compacted **TERRA-3000®** surface will never lose firmness on account of water or frost.

## **Why does a cover need to be placed upon a TERRA-3000® surface?**

**TERRA-3000®** is a substratum material. **TERRA-3000®** makes the ground sustainable and frost-proof. Nevertheless, the **TERRA-3000®** soil is not protected against abrasion. It is for this reason that an abrasion-proof sealing cover is necessary.



# General Questions about **TERRA-3000®**

**How long is it before traffic can use a road treated with **TERRA-3000®**?**

Immediately after optimum compacting, rolling and application of a cover.

**Is it also possible to apply **TERRA-3000®** in the rain?**

Of course that's possible, providing that the soil can still take in water. As soon as puddles start to build and the applied **TERRA-3000®** water can no longer be absorbed by the soil, **TERRA-3000®** application must be stopped.

**Is it also possible to apply **TERRA-3000®** when the ground was not decompacted previously?**

Yes. However, one should check whether the soil can absorb water. In other words, can the **TERRA-3000®** water from the container be taken in by the soil or does it spread across the surface? If the latter applies, the soil should be decompacted slightly (3cm) to enable it to absorb water. In the majority of cases this is not necessary.

**Is a road treated with **TERRA-3000®** able to withstand heavy goods lorries?**

Yes. Provided that the **TERRA-3000®** substratum has been optimally compacted, such surfaces have high load-bearing properties. This can be demonstrated in **plate loading tests**.



# General Questions about **TERRA-3000®**

## **What are the temperature properties of surfaces treated with TERRA-3000®?**

Temperature, whether rising or falling, has absolutely no effect on the application of **TERRA-3000®**. There are **TERRA-3000®** roads in Egypt, for which unimaginably high levels of heat have no negative effect at all. Paths and squares treated with **TERRA-3000®** have existed in Romania since for more than 10 years. Temperatures ranging from -20° to 30° have been recorded here. Both extreme heat and extreme cold have no effect on paths treated with **TERRA-3000®**.

## **Is the ground water damaged as a result of TERRA-3000® treatment of roads, paths and squares?**

No. In diluted form, in accordance with our usage instructions, **TERRA-3000®** is harmless and environmental.

## **Is it also possible to strengthen a path or square treated with TERRA-3000® without a roller?**

You can also use "vibratory plates" as a means of compaction. The vibratory plates must be as heavy as possible however in order to achieve the appropriate levels of surface firmness afterwards. It goes without saying that, for example, a nature trail not to be used by heavy lorries, does not require the use of a super-heavy compactor. Regardless of the situation, the surface must be optimally compacted, in other words to the correct moisture level (which can be determined using a Proctor test).



# General Questions about **TERRA-3000®**

**To what degree of incline can TERRA-3000® be used on a slope?**

This depends on the available compactor.

**What is the degree of frost sensitivity of paths, squares and roads treated by TERRA-3000®?**

Providing it is optimally compacted, there is no longer any frost sensitivity. A surface treated with **TERRA-3000®** is frozen-proof.

**Are plants and trees close to paths and roads treated with TERRA-3000® adversely affected by it?**

No, in no way. Years of experience has shown that plants and trees continue to vegetate.

**Is it also possible to spray TERRA-3000® on turf?**

No, one must first remove the turf. Roots cannot be strengthened because of they are organic components.

**Are paths treated with TERRA-3000®, which have a water bound cover, dusty?**

The build up of dust cannot be fully prevented, but it can be reduced to 75 %.



# General Questions about **TERRA-3000®**

## **Is TERRA-3000® poisonous?**

In concentrated form, **TERRA-3000®** is slightly caustic. The concentrate must not be drunk and not brought into contact with clothing. In the prescribed diluted form, **TERRA-3000®** is however fully harmless.

## **What guarantees are provided for TERRA-3000® roads?**

First of all, we are liable for, and provide a guarantee for the faultless quality of **TERRA-3000®**. Since we have no control over how the product is used, we cannot provide a guarantee for the construction work carried out. Such guarantees are provided by the firm (s) carrying out the work. Providing that the construction firm in question follows the specified usage instructions.

## **Is TERRA-3000® suitable for pure sand paths?**

Sand paths must have a fine soil particle content of at least 20%. A soil analysis can be used here.

## **What is the resistance of TERRA-3000® paths against oil, diesel, fuel and similar?**

No kind of negative effects have been documented.

## **In what way are paths which have a chalk- crushed stone mixture and which soften in rain suitable for TERRA-3000® treatment?**

These properties make usage of **TERRA-3000®** suitable. No softening takes place when **TERRA-3000®** is used correctly.



# General Questions about **TERRA-3000®**

**Is it possible to use TERRA-3000® to improve existing forest trails, with a water bound cover, which have been destroyed by frost and water?**

Yes. Later on, there are no more problems with potholes resulting from thaw damage. Such paths are then reprofiled, **TERRA-3000®** is applied and then optimally compacted.

**How does TERRA-3000® behave on forest trails, for which the treetops prevent sunlight from ever reaching the ground, which at the same time receive approx. 1,500mm plus of precipitation? In addition, where there is a steep slope and the hardest possible strong-binding clay soils are present?**

Such paths which are difficult to treat, which have never been firm and always soften, are the best example for **TERRA-3000®** treatment. When applied correctly and according to our usage instructions, such paths will always remain dry and cannot be destroyed by frost or water.

**Is it possible to use TERRA-3000® when constructing pipeline ditches?**

Yes. Large savings are made since one can use the same material to fill the ditches for pipework as was used when excavating. In this case, compaction must take place on a layer by layer basis. It is possible to install the excavated soil material on the side of the ditch and allow it to take effect. This mixture is later used to fill in the ditch. The result is a compactable, frost-proof material. If the soil cannot be installed next to the ditch, this soil, in places where excavation has already taken place, can be refilled immediately, treated on a layer by layer basis with **TERRA-3000®** and compacted on a layer-by-layer basis.



# General Questions about **TERRA-3000®**

**Is it possible to subsequently rip up ground, under which sewage- and other pipes have been laid after TERRA-3000® treatment using a pickaxe or hoe?**

It is possible but it would involve a great deal of effort. It would be better to carry out this work with a digger since **TERRA-3000®** surfaces, after optimum compaction, are firm.

**Is it possible to use TERRA-3000® for pavements and similar?**

Yes and in various forms. Either as a normal dirt road, which is treated with **TERRA-3000®**, or as a pavement upon which plates are added or asphalt poured. The entire substratum is no longer required. The existing soil is treated or is evened out with soil material, whether by digging out or excavation.

**Is it possible to use TERRA-3000® with interlocking paving?**

Yes. The entire substratum is no longer required, and can save on the strength of the interlocking paving.

**Is it possible to create a car park from simple farmland using TERRA-3000®?**

Yes, this is ideal. In this case, no soil needs to be excavated. Instead, according to our usage instructions, only the humus must be removed and the coarse subgrade can be created from the existing soil. Everything is treated with **TERRA-3000®**, optimally compacted and the required cover is added. Large cost savings are possible here.



# General Questions about **TERRA-3000®**

**What can be done about roads damaged by frost? Can TERRA-3000® help?**

**TERRA-3000®** can help here.

However, as in conventional restoration, the cover must first be removed.

After doing so, the surface is planed. In other words, the road is brought to the required height and **TERRA-3000®** is applied. After optimum compaction, the cover is re-applied. This cover can no longer be attacked by water and frost. It can only be damaged by normal wear and tear.

**Can a workshop be built with TERRA-3000® in an industrial area, which is used by heavy transporters, lorries, cranes and fork-lifts?**

Yes. This is a good opportunity to see the load bearing capacity of **TERRA-3000®** surfaces. Even with extremely heavily used roads, one can do without anti-frost and subbase levels. Only a cover is required, but one which can be significantly less strong than in conventional construction methods.

**Can TERRA-3000® be used to construct a lorry car park and turning circle for 40 t. trucks?**

Yes. No reconstruction is required. Instead, one takes the existing surface and uses it as a sub-base after **TERRA-3000®** treatment. One can freely choose the type of cover.

**Is TERRA-3000® only effective with grown soil or can it also be used to treat a ballasted surface with numerous potholes and frost damage?**

Yes. This can be done when these surfaces do not stand firm in the substratum but instead soften and give away again and again.



# Construction sites

Biogas - area Austria



Forest road Austria



Construction of road Austria



# Construction sites

Mountain road - Italia



Building site - Russia



Building site - turkey



# Construction sites



# Construction sites



# Construction sites

Mountain road - Peru



Construction Road - Austria



Measurement of sustainability - Austria



# TERRASYSTEM®

NANO - TECHNOLOGIE

This is where you contact us:

**TERRA-SYSTEM**  
**Bodenstabilisierung Betriebsges.m.b.H.**

**Untergroßau 178**  
**A-8261 Sinabelkirchen**  
**TEL: + 43 3118 5110 – Fax –DW4**

**Email: [terra.system@aon.at](mailto:terra.system@aon.at)**  
**http: [www.terra-3000-com](http://www.terra-3000-com)**

