

# COMPRESSED AIR DRYERS

**mikropor**

## INSTRUCTION MANUAL

MK-US SERIES (MK-US 10 to MK-US 5000)



### WARRANTY NOTICE

Failure to follow the instructions and procedures in this manual or misuse of this equipment will VOID its warranty !



**Manufacturing Forward**



**COMPRESSED**  
AIR ADVISORS  
— [www.compressedairadvisors.com](http://www.compressedairadvisors.com) —

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# Declaration of Conformity

## PED 2014/68/EU

(NB No : 0408)

<b>Manufacturer</b>	Mikropor Filters I.OSB Büyük Selçuklu Caddesi, No:4 06935 Ankara/Turkey Phone: 0312 267 0770 Fax: 0312 267 0552
<b>Product Description</b>  <b>Serial No of Set (device)</b>  <b>Type of Product</b>  <b>Module</b>	Air Dryer MK-US 10 (...), MK-US 15 (...), MK-US 25 (...), MK-US 35 (...), MK-US 60 (...), MK-US 75 (...), MK-US 100 (...), MK-US 125 (...), MK-US 140 (...), MK-US 175 (...), MK-US 200 (...), MK-US 250 (...), MK-US 350 (...), MK-US 425 (...), MK-US 550 (...), MK-US 700 (...), MK-US 900 (...), MK-US 1100 (...), MK-US 1350 (...), MK-US 1500 (...), MK-US 2000 (...), MK-US 2350 (...), MK-US 2750 (...), MK-US 3000 (...), MK-US 3600 (...), MK-US 4000 (...), MK-US 5000 (...),  0117MA00001 to 5217MA99999  CAT II Air Dryer  Module A2
<b>Assesment Modele</b>  <b>Confirmed By</b> <b>TÜV Austria Service GMBH</b> <b>Kind of inspection certification supplied standards</b> <b>Certificate No:</b> <b>Modules for compatibility assesment of pressure in-build elements;</b>  <b>Exchanger</b> <b>Receiver</b> <b>Separator</b> <b>Compressor</b>	Module A2 type compatibility  Notified Body No 0408 Addres; Deutschstreassee 10 1230 Wien/Österreich PED (2014/68/EU) Certification EN378-2  ZSTS / SWZE / 1790  CAT II MODUL A2 CAT I MODUL A2 CAT I MODUL A2 CAT I MODUL A2
<b>Product Responsibility</b>	Mikropor Filter is responsible for product in conditions it was delivered. Any modifications are forbidden. Product be operated according to its application. In case of breaking above conditions realized manufacturer from responsibility for the product CE mark of the product will be not valid.
<b>Signature</b>	
<b>Local Quality Manager, Pressure Vessel</b>	Ahmet Emin ÇAMLİBEL Date; 29.03.2017

# EC DECLARATION OF CONFORMITY



## MANUFACTURER

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*Name and Address of the  
Person authorised to compile the technical file*

: Ahmet Emin ÇAMLIBEL  
Organize Sanayi Bölgesi Büyük Selçuklu  
Bulvarı No. 4, 06935, Ankara -Türkiye

The undersigned declares that the described products meet the essential requirements of the below mentioned standards as based on Machinery Directive 2006/42/EC, Low Voltage Directive 2014/35/EU, Electromagnetic Compatibility Directive 2014/30/EU

The item of equipments which identified below has been subject to internal manufacturing checks with monitoring of the final assesment by Mikropor

### MACHINE DESCRIPTION MODELS : Air Dryer

MK-US 10 (...), MK-US 15 (...), MK-US 25 (...), MK-US 35 (...), MK-US 60 (...), MK-US 75 (...), MK-US 100 (...), MK-US 125 (...), MK-US 140 (...), MK-US 175 (...), MK-US 200 (...), MK-US 250 (...), MK-US 350 (...), MK-US 425 (...), MK-US 550 (...), MK-US 700 (...), MK-US 900 (...), MK-US 1100 (...), MK-US 1350 (...), MK-US 1500 (...), MK-US 2000 (...), MK-US 2350 (...), MK-US 2750 (...), MK-US 3000 (...), MK-US 3600 (...), MK-US 4000 (...), MK-US 5000 (...),

**Serial No of Set (device):** 0117MA00001 to 5217MA99999

### APPLICABLE DIRECTIVES :

2006/42/EC MACHINE SAFETY DIRECTIVE  
2014/35/EU LOW VOLTAGE DIRECTIVE  
2014/30/EU ELECTROMAGNETIC COMPATIBILITY DIRECTIVE

**Certificate No:** 16-PS-0279-TAT-16-MAD-1059

### APPLICABLE REGULATIONS :

EN ISO 12100:2010; EN 60204-1:2006/AC:2010; EN 61000-6-2:2005; EN 61000-6-4:2007+A1:2011  
EN 378-2

### SIGNED ON BE HALF OF THE MANUFACTURER

**NAME** : Mustafa Uslu  
**POSITION** : R&D Manager  
**PLACE/ DATE** : ANKARA / 03.04.2017

**SIGNATURE**

:



## I. IMPORTANT SAFETY NOTES



When operating the air dryer the operator must apply safe working methods and observe all local safety instructions and relevant regulations.

- A)** Prior to installation, the dryer and the compressed air system are to be depressurized and disconnected from the electrical main supply.
- B)** The user is responsible for safe operating conditions. Parts and accessories must be replaced if inspection shows that safe operation cannot be assured.
- C)** Installation, operation, maintenance and repair are only to be authorized, trained and skilled engineers.
- D)** The minimum and maximum values stated must be observed, as well as all of the safety precautions described in this manual.
- E)** If any statement in this manual does not comply with the local legislation, the strongest standard is to be applied.

### 1.1. Transportation

- A)** Use care and caution when transporting the dryer. Avoid dropping and other physical abuse.
- B)** A forklift can be used to transport the dryers provided the forks are long enough to support its full width or length and caution is used throughout the move.

### 1.2. Positioning

- A)** The dryer must be installed horizontally. A minimum of 19.6 in. clearance around the dryer is necessary to allow a good ventilation and easy access for servicing.
- B)** The ambient temperature in the room should not exceed 113°F and should not be below 39.2°F, taking the heat radiated by the dryer into account.
- C)** (40 watt for each liter/sec under ISO 7183-A condition or 18 watts for each SCFM under ISO 7183-B condition).
- D)** There should be no chemicals in the atmosphere that will damage the copper source. (Ammonia gas etc.)

### 1.3. Installation

In addition to the general mechanical construction procedures and local regulations, the following instructions need to be emphasized:

- 1)** Only authorized, trained and skilled engineers should install the compressed air dryer.
- 2)** Safety devices, protecting covers or insulation in the dryers never to be dismantled or modified. Each pressure vessel or accessory installed outside the dryer with air above atmospheric pressure must be fitted with the required pressure relief safety valves.

### 1.4. Before Operating

The following points must be observed before operating the air dryer:

- A)** Review all safety precautions.
- B)** The dryer connection piping measurements must be selected correctly. (See Technical specifications)
- C)** The dryer connection piping must be adapted to the operating pressure. (See Technical specifications)
- D)** Never operate the dryer at pressure above the maximum specified on the dryer label (check the technical specs too).
- E)** The drains should be opened to atmosphere. If the drains are connected to a pipe / hose, the diameter of the hose / pipe should be large enough to create no back pressure during drain. It is not recommended to reduce the diameter of the hose / pipe less than port that is given at the drain outlet of the unit. The hose / pipe should be at atmospheric pressure at all time. Back pressure in relevant pipe will result in permanent damage on drain system and the affect function of the filters and / or dryers.



## 1.5. Qualified service personnel

- A) Maintenance and repairs should only be performed when the air dryer is shut down and depressurized and when the main power switch is turned off.
- B) Use only the appropriate tools for maintenance and repair.
- C) Before dismantling a part under pressure, disconnect the pressure sources and depressurize the system.
- D) Proceed carefully during maintenance and repair. Prevent dirt from entering by covering parts and orifices with a clean cloth, paper or tape. A receiver should never be welded or modified in any way.
- E) Never leave tools, loose parts or cleaning rags in or on the air dryer.
- F) Before returning the dryer into service, check the setting of the control and safety devices as well as the pressure and the temperature of the compressed air circuit.

## 1.6. Maintenance by the user

- A) Keep the dryer clean.
- B) Regularly check the correct operation of the condensate drain trap.
- C) Every six months, check and clean the drain strainer by undoing the access screw and rinsing the filter with tap water to remove the trapped dirt from the inside.
- D) For aircooled dryers, clean the air condenser as soon as it's dirty or clogged.
- E) For optional water-cooled condensers, use only clean water and install a water filter if needed. Use water counter flow to clean condenser if need.
- F) Check the trouble-shooting list in case of maintenance troubles.
- G) Check operating pressures, temperatures and time settings after maintenance. If operating and safety devices function properly, the air dryer may be used.

## 2. INTRODUCTION TO THE DRYER

### A) Manufacturer:

MIKROPOR / [www.mikropor.com](http://www.mikropor.com)



### B) Purpose of this dryer

- 1) This refrigerated compressed air dryer has been designed to remove water vapor from industrial compressed air.
- 2) This dryer has been designed for indoor operation.
- 3) The minimum and maximum values stated must be observed, as well as the safety precautions described in this manual.



## C) Dryer label

The following label is affixed on the cabinet of the refrigerant compressed air dryer.

		<b>Mikropor America Inc.</b> 251 N.Roeske Avenue Michigan City, IN 46360 www.mikroporamerica.com	
<b>MODEL NO: MKUS</b>		<b>SERIAL NO:</b>	
		MKUS	
Max. Refrigerant Pressure		Voltage	
Max. Air Pressure		P Rating	
Max. Air Inlet Temp.		Refrigerant R134a	
Min. Ambient Temp.		Weight	
Max. Ambient Temp.		Fan	
Min. Circuit Ampacity		Compressor	
Max. Protective Device Rating			

### Dryer label descriptions

Model No:	Dryer model no
Serial No:	Dryer serial no
Max Refrigerant Pressure:	Dryer maximum working pressure
Max. Air Pressure:	Maximum air pressure
Max. Air Inlet Temp:	Maximum air inlet temperature
Min. Ambient Temp. :	Minimum ambient temperature
Max. Ambient Temp. :	Maximum ambient temperature
Min. Circuit Ampacity :	Maximum allowed amount of current
Max Protective Device Rating :	Maximum protective device rating
Voltage :	Main supply voltage
IP Rating :	Protection rating
Refrigerant 134a :	Amount of refrigerant gas used
Weight :	Dryer weight
Fan :	Model of fan used
Compressor :	Model of compressor used

## D) Working details

### 1) Refrigerant circuit:

The refrigerant circuit can be divided in **3** parts:

- A) Low pressure section with an evaporator (heat exchanger)
- B) High-pressure section including: Condenser, liquid receiver, (if installed) and the filter dryer.
- C) Control circuit including: Compressor, Expansion valve, by-pass valve (if installed), Fan pressure switch (if installed)

### 2) For water - cooled dryers:

- A) Water valve
- B) Safety high pressure switch (if installed)

### 3) The Refrigerant circuit operates as follows:

- A) The compressor compresses gaseous refrigerant to a high temperature.
- B) The hot refrigerant condenses in the condenser. Being liquefied it is stored in the liquid receiver (if installed).
- C) The liquid is taken out the storage vessel and injected in the evaporator (heat exchanger) by an expansion valve. This expansion valve is protected by a filter, which removes particles and humidity that could be in the circuit.
- D) The injected liquid fills in the refrigerant section of the air / refrigerant heat exchanger and evaporates by taking out the calories from the compressed air. The gaseous refrigerant is sucked in the compressor and the cycle carries on.
- E) In order to keep the evaporation pressure steady, and thus the refrigerant temperature in the heat exchanger, a by-pass valve is injecting hot gaseous refrigerant in the circuit. On certain dryers, an automatic expansion valve regulates this.

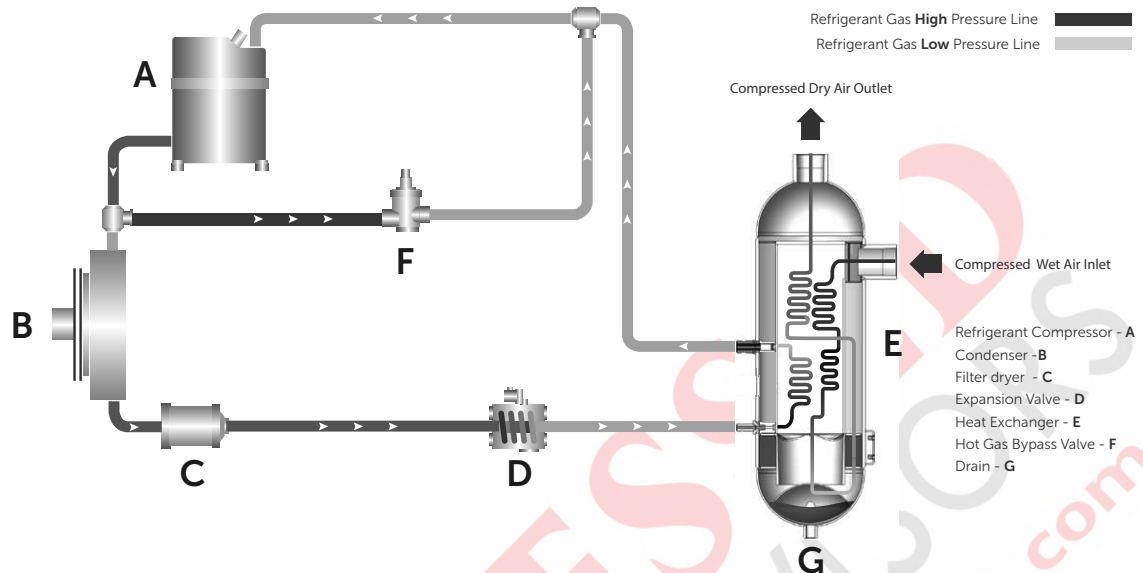
### 4) Compressed air circuit:

- A) The saturated hot compressed air flows into the Economiser where it is pre-cooled by the out flowing dry chilled air. In the cold zone of the air refrigerant section it continues to cool down to dew point and enters the separator where condensates are collected. The outgoing chilled air is then warmed up in the economizer by the hot incoming air.



- B)** The condensates are collected after centrifugal separation and drained out through the automatic trap.
- C)** As long as the compressed air temperature does not drop below dew point, there will be no condensation in the air circuit.

## Compressed Air Dryer Working Principle



### 5) Refrigerant compressor

Increases the pressure and temperature of refrigerant. There are two type of compressors commonly used according to refrigerant capacity on this application:

- Piston type
- Scroll type

### 6) Condenser

Dissipates the heat provided by evaporator and compressor.

There are two type of condensers used on the application:

- Air Cooled Type (standard)

These condensers are designed to dissipate the heat to the ambient air.

The fans are used to force the air flow through the fins to enhance the heat transfer.

- Water Cooled Type (optional)

These condensers are designed to dissipate the heat to a water flow.

A shell and tube heat exchanger is used for this purpose.

### 7) Refrigerant circuit protection

**A)** Klixon: The single phase compressors are equipped with a klixon which is a thermal sensitive switch controlling the temperature of the compressor and possible overintensity.

In case of malfunction, the klixon trips but switches on again automatically as soon as the compressor has cooled down.

**B)** High Pressure Security Switch: Refrigerant line is considered as a pressure vessel. That is why it is protected against bursts by the help of manually reset switch. It is set to 362 psi for dryers working with R134a

**C)** Filter dryer: A refrigerant circuit is a closed circuit and total water removal in the refrigerant circuit is paramount in order to obtain a correct functioning.

**D)** To avoid problems, the refrigerant circuit must be vacuumed before loading the refrigerant.

It is equipped with a filter dryer, which also traps any solid particles, which may have migrated into the circuit during assembly.

**E)** Water-cooled dryers have a safety high-pressure switch.

In case of cooling water failure, the safety switch stops the dryer. When the safety switch has tripped out, it has to be manually resettled before switching on the dryer.

## 8) Refrigerant circuit controls

**A)** Liquid refrigerant injection: The liquid refrigerant is into the evaporator by a control valve. This valve is a thermostatic or pressostatic one maintaining a constant overheats of the refrigerant in the evaporator(s).

**B)** Constant evaporating pressure: In the dryers equipped with a by-pass valve, the evaporating pressure is kept constant by a controlled injection of hot gas from the high-pressure side into the low-pressure section of the circuit.

## 9) Condensate drain - trap assembly

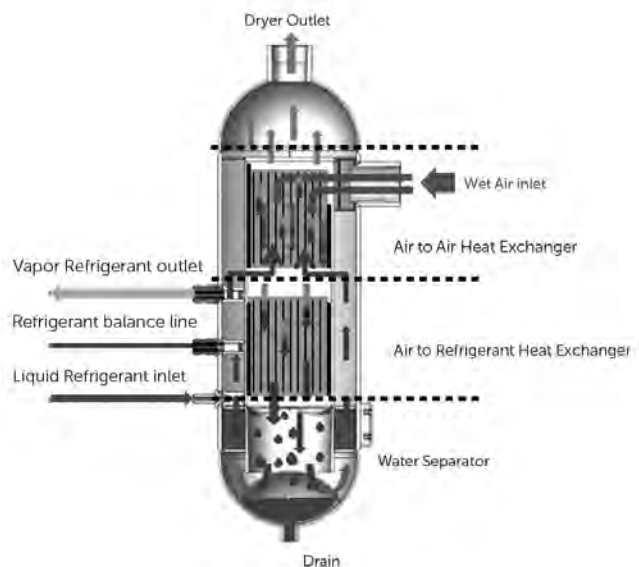
Dismantling the drain is easy because it can be isolated from the air circuit under pressure with a ball valve. The drain has to be depressurized before being dismantled.

## 10) Heat Exchanger Modular design

**A)** The dryers are equipped with a compact Mono Bloc Heat Exchanger module.

This assembly has been specially designed to dry compressed air and is made of:

- 1) An Economiser which pre-cools the entering hot air with the out flowing cold air.
- 2) An air/refrigerant exchanger cooling down the compressed air.
- 3) A centrifugal separator concentrating all condensates and requiring no maintenance.



## 11) Accessories

**Temperature switch:** Temperature switch: Located inside the dryer, this temperature switch is adjustable from 32°F up to 95 °F.

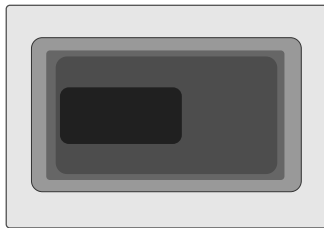
**Digital Controller –DigiPro:** This device helps dryer save energy when there is not any compressed air flow in the dryer. Those information can be reached; Dewpoint value, periodic maintenance interval display, status report, run time meter, temperature unit selection (°F or °C)

**Digital Controller – ESD3: Energy Saving Device: (ESD)** This device helps dryer save energy when there is not any compressed air flow in the dryer. Those information can be reached; Dewpoint value, periodic maintenance interval display, status report, run time meter, temperature unit selection (°F or °C)  
(Please see the models have standard and optional in next page)

### 3. OPERATION

## Control panels for MK-US Series

The control panel of the dryer includes the following elements:



Monophase	Digital Controller
MK-US 10 - MK-US 200	Digi-Pro



Triphase	Digital Controller	Accessories
MK-US 250 - MK-US 425	Digi-Pro	Main Switch



Triphase	Digital Controller	Accessories
MK-US 550 - MK-US 5000	ESD3	Emergency Stop



#### IMPORTANT NOTE

The Dryer has two Compressed Air Filter inside.

It is better to change filter element for the best efficiency when the alarm status is active.

It is recommended to keep replacement filter elements in your stock in order to replace them when needed.



#### ATTENTION

MK-US range dryers have low pressure drop according its competitors.

Do not use MK-US range dryers together with other dryers which have higher pressure drop without getting the confirmation from our technical team.



### 3.1. During Operation

Regularly check the digital temperature controller ESD3 or Digi-Pro on dryer.

### 3.2 Start up and shut-down

Warning: Avoid leaving the dryer off when compressed air is still flowing through it.

### 3.3 Starting for the first time or after a long stop

1) Set the rotary switch to "I" This preheats the dryer and turns the drain system on.  
It is recommended to leave the dryer power on permanently so the crankcase heater runs continuously.



#### IMPORTANT NOTE!

2) After a long stop of the dryer it is MANDATORY to allow a preheating period of minimum 4 hours before starting again, to avoid any compressed air flow during preheating.

3) Follow the daily starting and shut down procedure.

### 3.4 Daily starting and shut-down

1) Push on the ON button to start the dryer.  
2) The start light or Dryer Active will indicate that the dryer is running.  
3) To stop the dryer, first stop the airflow (either shut-down the air compressor or close the inlet/outlet or by-pass valve) When the air flow is stopped, set the rotary switch on "0" Set it again on "I" in order to keep the preheating on.



#### IMPORTANT NOTE !

4) Avoid leaving the dryer stopped when compressed air is still flowing through it.  
5) To switch the already preheated dryer on again, simply push the green start button.

## 4) ELECTRICAL CONTROLLER

### 4.1 DIGI-PRO

#### 4.1.1 Description

With the Digi-Pro series controllers, air dryers have outstanding technology for both functionality and dynamism, as well as appearance. The multi-functional display provides an accurate digital dew point display as well as coded alarm monitoring of the refrigerant dryer.

#### DIGITAL CONTROLLER ADVANTAGES;

- Digital dew point monitoring
- Energy-saving mode display
- Periodic maintenance interval display
- Status report
- Run time meter
- Fahrenheit and Centigrade selection

#### 4.1.2 Operation

Using the Digi Pro controller as shown in the picture below:



#### 4.1.3 Menu Buttons



**PROGRAM**

To modify the parameter, press and release button set. The menu is used by service team. To disable the Key Lock: Press and hold the SET for 4 sec.



**POWER**

This button is used for starting and stopping the dryer. Press and hold for 4 seconds to start or stop.



**MENU**

These buttons are used to navigate between screens and adjust values.



**MANUAL DRAIN**

This button is used for manual control of the drain output. Press and hold for 4 seconds to drain manually.



#### 4.1.4 ALARM DISPLAY



Alarms / warnings are displayed on the digital screen. That means the dryer is not working under normal operating conditions, which are outside the range of set values.

Alarm Code	Alarm Description	Reason for Alarm
tAL	Low Temperature Alarm	Refrigerant line temperature is lower than specified set values
tAH	High Temperature Alarm	Refrigerant line temperature is higher than specified set values
FIL	Filter Change Alarm	Filter element needs to be replaced
SEr	General Service Alarm	General service time of the dryer
HPr	High Pressure Alarm	Refrigerant high line pressure is higher than specified set values
Pr1	Temperature Probe Alarm	Temperature sensor is faulty.
hFI	Working Hours Alarm	The dryer working hours allowed has been reached.



Please contact to the service when an alarm/warning occurs.

#### 4.1.5 MODE DISPLAY



**DRYER ACTIVE MODE**

This mark indicates that the dryer is performed in active state and drying.



**AUTOMATIC DRAIN MODE**

Shows if the drain system is activated.



**ENERGY SAVING MODE**

Shows if the energy saving mode is activated



**CELSIUS UNIT MODE**

Indicates that Celsius temperature unit is selected.



**FAHRENHEIT UNIT MODE**

Indicates that Fahrenheit temperature unit is selected.



**COMPRESSOR STANDBY MODE**

This mode shows that the dryer is ready for drying operation.



**SERVICE MODE**

This mode shows that the dryer in the service time.



## 4.2 ESD 3

### 4.2.1 DESCRIPTION

E-687 is designed as a controller for refrigerant type compressed air dryers. The controller has 8 temperature sensor inputs.

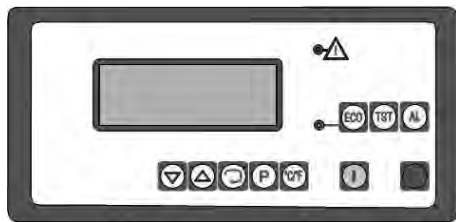
The controller has an RS-485 communication interface that can be used for remotely monitoring channel temperatures, set points, input and output states. Modbus RTU protocol is used for communication.

The front panel of the controller contains a four line 20 character LCD display and buttons that are used in configuration and manual control operations.

The dimensions of the controller are 3.7 x 7.5 in. (front panel) with a depth of 4.3 in. . The panel cutout should be 3.5 x 7.2 in. . The operating voltage of the controller is 20 - 60V AC or 20 - 85V DC.

### 4.2.2 OPERATION

The front panel view of E-687 controller is given in the below figure. The front panel of the controller contains a four line 20 character LCD display, 10 buttons and 2 indicator leds.



The Front Panel View of E-687 Controller

**ECO** button is used to enable or disable the ECO (economy) mode. Pressing this button complements the state of ECO, i.e. if it is enabled; disables, if it is disabled; enables the ECO mode. The green led on the left side of the **ECO** button lights if the ECO mode is enabled.

**TST** button is used for manual control of the drain output.

**AL** button is used for alarm acknowledge. The dryer is automatically stopped if an anomaly is detected. In that case, the alarm output and the alarm indicator led (red) on the front panel become activated. In order to restart the dryer, alarm should be acknowledged and "restart delay" period should be timed out. Pressing **AL** button acknowledges the alarm and reenergizes the alarm output and alarm led.

The buttons below the LCD display ( **↓** , **↑** , **←** and **→** ) are used in screen selection and configuration operations.

**°C/°F** button is used to change the temperature unit from °C to °F or vice versa.

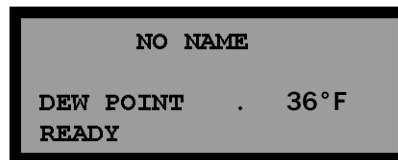
**I** and **O** buttons are used for starting and stopping the dryer respectively. If the dryer is stopped manually, it can not be started before "restart delay" period is timed out.

**°C/°F** , **ECO** , **TST** , **AL** , **I** and **O** buttons are disabled during configuration operations.

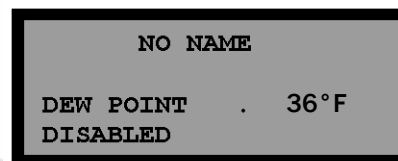
## 4.2.3 OPERATION SCREENS

### 4.2.3.1 The Normal Operation Screen

When the controller is powered on, it displays the type and version message, and then the restart delay timer is set to 5 seconds. After 5 seconds, the normal operation screen is displayed as shown in below figure



The exchanger temperature (Dew Point) and operation state of the dryer is displayed in this screen. If there is a situation which will prevent the operation of the dryer then the "READY" message in the last line will become "DISABLED". See below figure



**In order to start the dryer, the following conditions must be satisfied.**

1. All the temperatures except the exchanger temperature and condenser outlet temperature must be between their low and high limits. The low pressure line temperature can be 'HIGH'.
2. Digital Input 3 (Compressor Fault) is not activated.
3. Digital Input 4 (Compressor Overload) is not activated.
4. Digital Input 5 (Fan Fault) is not activated.
5. Digital Input 6 (Fan Overload) is not activated.
6. Digital Input 7 (Phase Sequence Error) is not activated.
7. Digital Input 8 (Remote Disable) is not activated.
8. Digital Input 11 (High Pressure) is not activated.
9. Digital Input 12 (Low Pressure) is not activated.

If all the above conditions are satisfied, the message in the last line of the normal operation screen will be "READY" and the dryer can be started either pressing button on the front panel or activating Digital Input 1 (Remote Start) or activating Digital Input 13 (Remote Control). When the dryer is started, the normal operation screen is displayed as shown in below figure.

NO NAME	
DEW POINT	. 36°F
RUNNING	DRAIN ON

In the beginning, Digital Output 1 (Compressor Motor), Digital Output 2 (Drain Output) and Digital Output 3 (Dryer is Running) become active. While in normal operation, the drain output is controlled according to the configured "drain on" and "drain off" periods. "DRAIN ON" message is displayed in the end of the last line while the drain output is active.

When the Digital Input 9 (Fan Motor is on) is activated, "FAN MOTOR IS ON" message is displayed in the second line as shown in below figure.

NO NAME	
FAN MOTOR IS ON	
DEW POINT	. 36°F
RUNNING	

Digital Input 14 (Water Pump is on) activates "WATER PUMP IS ON" message as shown in below figure.

NO NAME	
WATER PUMP IS ON	
DEW POINT	. 36°F
RUNNING	

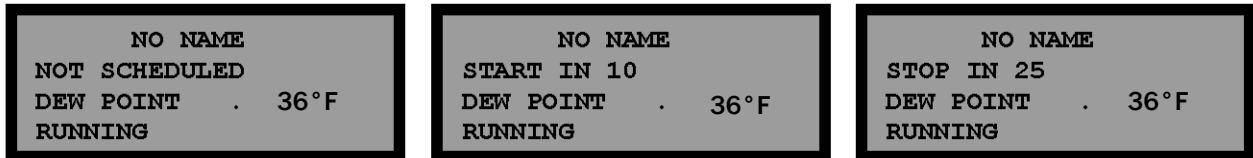
When ECO mode is enabled and the exchanger temperature is less than or equal to "ECO Start Set point" and this condition is prevailed more than "ECO Start Delay", then, the compressor motor is stopped and ECO operation starts. During the ECO operation the appearance of the display is given in below figure. The value at the end of the second row indicates the time in seconds since beginning of the ECO operation.

NO NAME	
ECO (SEC.)	: 324
DEW POINT	. 36°F
RUNNING	

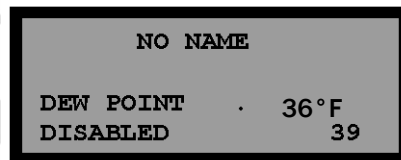


Pressing and keys simultaneously at this page toggles the controller between automatic and manual mode. In manual mode, the dryer starts and stops manually by using and buttons. Unlike the manual mode, automatic mode enables the controller start and stop automatically at pre-programmed times on a daily basis

When running in automatic mode, current scheduling information messages are also activated in the second line of the displays as show in below figure. "NOT SCHEDULED" message is displayed when no schedule exists. "START IN XXX" shows the time to the next scheduled program in minutes and "STOP IN XXX" message shows the time to the end of current running program in minutes.



If the dryer is stopped manually by using button, or activating Digital Input 2 (Remote Stop) or deactivating Digital Input 13 (Remote Control), the normal operating screen is displayed as shown in below figure. The number at the end of the last line indicates the remaining time in seconds from the restart delay. If this number becomes zero and there is no anomaly, the dryer can be restarted.



The first line in the normal operation screen (NO NAME) is user configurable. If the exchanger temperature sensor is broken, dew point temperature will be displayed as 1000°C.

### 4.3.3. The Info Screens

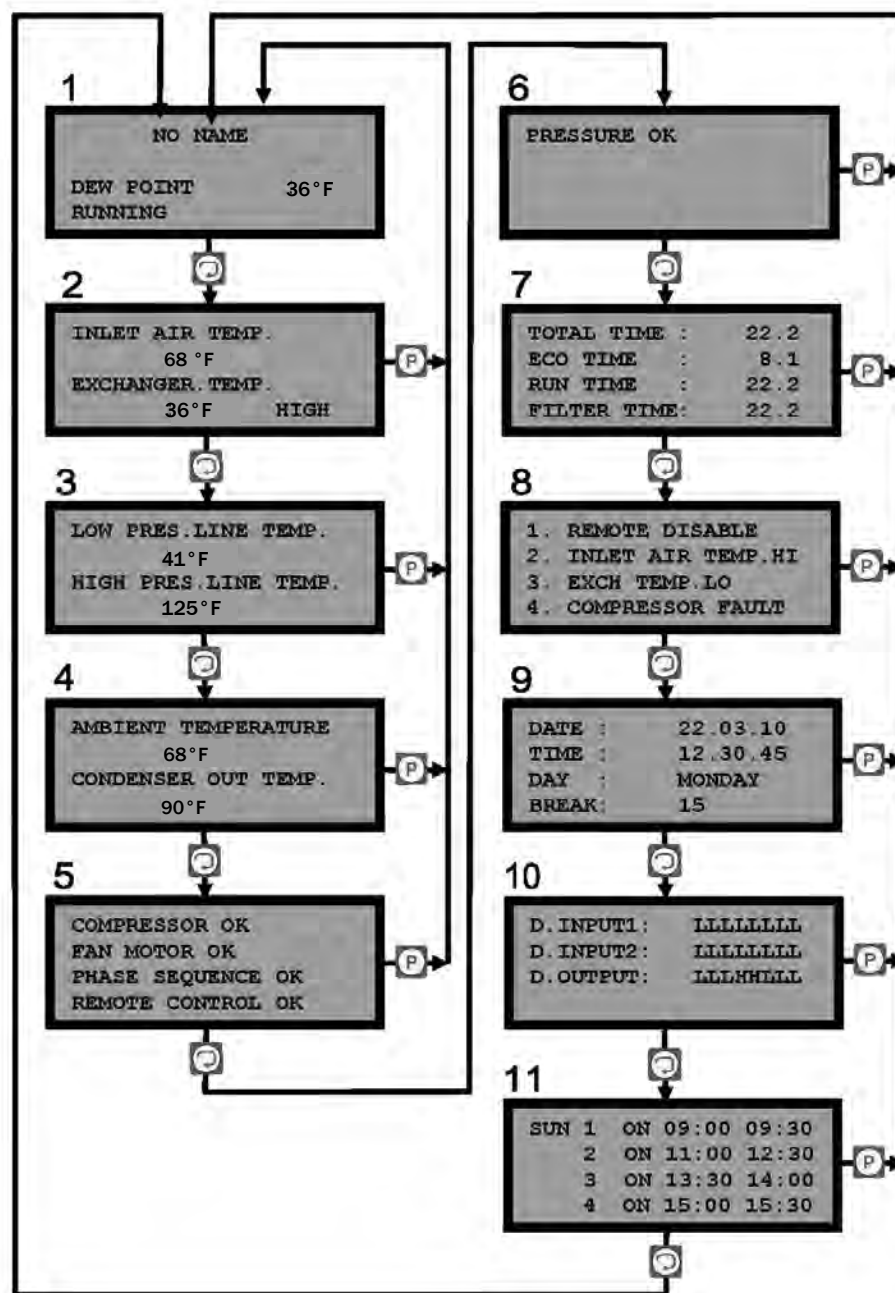
Various data related to the dryer can be monitored by sequentially pressing button. Pressing button, changes the display screen. While one screen is displayed, pressing button reverts to the normal operation screen. The flow chart for monitoring the dryer data is given in Figure 2.13. In this figure, screen numbers are shown on the upper left of the screens.

Screen1 is the normal operation screen. While this screen is displayed, pressing button selects Screen2. By successively pressing button, all the screens can be accessed. Screens may also be selected by and buttons.

In Screen2, Screen3 and Screen4, the sensor temperatures are displayed. If the measured temperatures are between their low and high limits, only the temperature value is displayed, otherwise **"LOW"** or **"HIGH"** message is added in the end of the line. In case of sensor break, only **"SENSOR BREAK"** message is displayed.

In screen 5 and 6 the states of the compressor motor, fan motor, the phase sequence, remote disable and air pressure are displayed. Actually this data is derived from the digital inputs.

The message in the first line of Screen5 is determined by Digital Input 3 and Digital Input 4 (Compressor Fault and Compressor Overload). in the below table shows the relation between digital inputs and the message.







Screen8 displays the last four events that caused the dryer to be stopped automatically. The possible alternatives for the messages are given below.

INLET AIR TEMP.LO	COMPRESSOR FAULT
INLET AIR TEMP.HI	COMP.OVERLOAD
EXCH.TEMP.LO	FAN MOTOR FAULT
EXCH.TEMP.HI	FAN MOT.OVERLOAD
LO.PRES.L.TEMP.LO	PHASE SEQ.ERROR
LO.PRES.L.TEMP.HI	REMOTE DISABLE
HI.PRES.L.TEMP.LO	PRESSURE HIGH
HI.PRES.L.TEMP.HI	PRESSURE LOW
AMB.TEMP.LO	CONDENSER FAULT
AMB.TEMP.HI	

Screen9 displays the date and time.

Screen10 displays the states of the digital inputs and digital outputs. The letters 'L' and 'H' stands for 'not activated' and 'activated' states respectively.

The data in the first line of Screen10 (D.INPUT1), from right to left corresponds to Digital Input 1 to 8.

The data in the second line of Screen10 (D.INPUT2), from right to left corresponds to Digital Input 9 to 16.

The data in the third line of Screen10 (D.OUTPUT), from right to left corresponds to Digital Output 1 to 8.

Screen11 displays automatic mode scheduling of the day. Please see Section 2.3.3 for scheduling for auto/manual selection.

#### 4.3.4 Operation Principles

**In order to start the dryer, the following conditions must be satisfied.**

1. All the temperatures except the exchanger temperature and condenser outlet temperature must be between their low and high limits. The low pressure line temperature can be 'HIGH'.
2. Digital Input 3 (Compressor Fault) is not activated.
3. Digital Input 4 (Compressor Overload) is not activated.
4. Digital Input 5 (Fan Fault) is not activated.
5. Digital Input 6 (Fan Overload) is not activated.
6. Digital Input 7 (Phase Sequence Error) is not activated.
7. Digital Input 8 (Remote Disable) is not activated.
8. Digital Input 11 (High Pressure) is not activated.
9. Digital Input 12 (Low Pressure) is not activated.

If all the above conditions are satisfied, the dryer can be started.





## 9. COMPONENTS LOCATION

All main components located into dryer identified with labels as listed here under.

CAUTION: Due to manufacture design, some components out of the list are not installed into the dryer.

### Electrical components:

#### Accessories :

A01:	Control circuit transformer
A02:	Power circuit transformer
A10:	ON warning light
A11:	OFF warning light
A20:	Drain solenoid valve
A30:	Crankcase heater
A31:	Electrical resistor
A40:	Electrical capacity
EV3	Digital Controller (Digi-Pro)
A50-3:	Energy saving device 3 (ESD3)

#### Relays :

K01:	Compressor motor relay
K10:	Fan motor relay
K20:	Drain timer or Bekomat (optional)
K30:	Temperature Controller

#### Switches :

S01:	Main switch
S02:	Start push button
S03:	Stop push button
S10:	Fan pressure control
S11:	High-low pressure security control
S12:	High pressure security control
S13:	Low pressure security control
S20:	Refrigerant temperature control
S21:	Air temperature control

#### Motors :

M01:	Refrigerant compressor motor
M10:	Fan motor

#### Thermal protections :

P01:	Refrigerant compressor thermal overload
P10:	Fan motor thermal overload

#### Fuses protections :

See complete identification into electrical sketch included in dryer

F--:	Transformer protection
F--:	Fan protection
F--:	Compressor relay protection
F--:	Transformer protection
F--:	Drain protection
F--:	Fan relay protection

#### Refrigerant components:

G01:	Liquid receiver
G02:	Refrigerant drier
G03:	Expansion valve
G04:	Liquid separator
G05:	Hot gas bypass valve
G06:	Refrigerant solenoid valve
G10:	Water cooled condenser
G11:	Water control valve
G20:	Refrigerant evaporating pressure gauge
G21:	Refrigerant evaporating temperature gauge

#### Compressed air components :

H01:	Air inlet prefilter
H11:	Drain filter
H12:	Pneumatic drain valve

#### Terminal boxes:

B01:	Main terminal box
B11:	Refrigerant unit terminal box
B12:	Free of potential terminal box

Problem	Possible Cause	Repair	Comments
Dryer is switched on, indicator light is lit but the refrigerant compressor does not turn on.	The connection has inverted phases	Invert two phases	3-phase dryers are equipped with a phase controller to avoid the fans from turning in the opposite direction.
	Refrigeration unit is not functioning	Check refrigeration compressor	Several factors can cause compressor failure. A qualified refrigeration technician needs to check all the electrical and refrigerant circuit and controls.
	The refrigerant highpressure protection has tripped	The refrigerant safety high pressure switch has tripped. In case of water cooled condensers, check the water control valve	The dryer is protected against excessively high refrigerant pressure. If the condenser efficiency has reduced, the switch will trip. Manually reset the switch.
	Excessive ambient temperature	Be sure that dryer is working in temperatures lower than the design conditions. Designed conditions and correction factors are described in this manual.	A high ambient temperature may cause the refrigerant system to operate at higher than normal pressures. Results will be higher than normal evaporator temperature. Important: adequate air circulation around the dryer, and proper ventilation in the equipment room should guarantee a low enough ambient temperature.
Dryer is switched on, but the refrigerant compressor does not turn on.	Excessive temperature on crankcase of compressor.	Allow time to compressor to cool down. Reason may be a possible incorrect adjustment of hot gas bypass valve or shortage of refrigerant	Compressor is protected against overly high temperatures of the crankcase by a thermal switch.
	Excessive compressed air inlet temperature.	Be sure that dryer is working in temperatures lower than design conditions.	The dryer is designed for working in calculated conditions (see description in this manual). If conditions are exceeded, the dryer will be overflowed, dew point will go up and protecting devices can switch off.
	Clogged condenser fins or clogged water condenser. Possible high crankcase temperature Possible loss of phase Possible low voltage causing overload trip Possible failed compressor	Clear fins or water condenser of all obstructions.	The clogged fins in the condenser will restrict the air passage and reduce the refrigeration capacity, causing high temperature in the evaporator. Same will occur if water condenser is clogged with mud or dirt. Air condenser and water condenser should be periodically checked and cleaned. Protect water circuit by an adapted filter.
	Too much compressed air flow.	Check actual flow through the dryer.	This dryer is designed for a maximum air flow at design conditions. If too much air is pumped into the dryer, water removal capacity may not be sufficient, resulting in liquid carryover down stream. Check the rated output the air compressor.
	Faulty electrical wiring	Inspect the circuit	The compressor-on light should be wired into the refrigerant compressor circuit. See wiring diagrams in this manual.
	One electrical protection has tripped.	Reset the protection or replace the blown fuse.	The dryer is protected against high amp draw by fuse and/or overload relay that can trip in case of need. Reset or replace fuse once, but do not persist if it trips again, request assistance from a qualified refrigeration contractor.
Dryer is switched on but fan is not running.	Fan has to run if refrigerant high pressure reaches upper set point.	Check that compressed air flows through the dryer. Check that fan blades are free to move. Check the fan pressure switch.	Fan operates automatically to keep refrigerant pressure below the maximum value. The fan can stop if pressure is under the recommended setting.
When compressor starts, it vibrates a lot and makes mechanical noise.	Compressor is slugging liquid refrigerant at start up.	Be sure the pre-heating period of at least 2 hours is respected	Refrigerant may move between receivers when refrigerant compressor is stopped and not heated, especially if stopped for a long time. This migration may cause liquid shock (slugging) in valves specially on large dryers containing more refrigerant



Problem	Possible Cause	Repair	Comments
Water in system	Compressed Air Inlet and outlet connections are reversed.	Check inlet and outlet connections.	This dryer is designed for air flow in one direction only. Inlet and outlet directions are identified on the dryer.
	Drain system is clogged or inoperative.	Restore a free flow of water condensate. Check water evacuation.	Drain system is timed solenoid valve, pneumatically assisted which has to be adjusted in accordance with values listed in this manual. The Solenoid valve includes a strainer that has to be periodically checked and cleaned. Membranes of pneumatically assisted drain have to be checked or replaced every 6 months.
	Bypass system is open	Check the valves	Important: Bypass piping should be installed around the dryer so the dryer can be isolated for service without shutting down the air supply. During dryer operation, valves must be set so all air goes into the system. Check tightness of the bypass system.
	Free moisture remains in pipe lines.	Blow out the system	Before the dryer is first started all free moisture should be blown out of the system.
	Excessive air flow	Check actual flow through the dryer.	This dryer is designed for a maximum air flow. If too much air is pumped into the dryer, water removal capacity may not be sufficient, resulting in liquid carry over downstream. Check the rated flow of the air compressor.
	Excessive free moisture	Check the separator and drain system and compressor after cooler ahead of the dryer.	In some system there may be an accumulation of free moisture in the line ahead of the dryer. If this moisture is pumped into the dryer intermittently, the water removal capacity may not be sufficient. A water separator should be installed in the line before the dryer.
	Excessive compressed air inlet temperature.	Be sure that dryer is working lower than design conditions	The dryer is designed to work for calculated design conditions. Should the conditions be exceeded, the dryer will be overflowed, dew point will go up and protecting devices can switch off.
	Clogged condenser fins	Clear fins of all obstructions	The clogged fins in the condenser will restrict air passage and reduce refrigerant capacity causing water downstream. Fins should be periodically checked and cleaned.
	Shortage of refrigerant	Fix the leak and add a charge of refrigerant.	Loss of refrigerant will cause improper functioning. A qualified, refrigeration specialist should perform the necessary repairs, or factory should be contacted if the unit is in warranty.
	Refrigeration system is not functioning	Check to be certain refrigerant compressor is running	To check if the compressor is running, check compressor-on light. It is possible for the fan to be operating but not the compressor. Compressor not running can be caused by several factors. A qualified refrigeration technician should check all refrigerant and electrical controls
	Excessive pressure dew point	Readjust refrigerant evaporating pressure	The refrigerant pressure adjustment should be done by a qualified refrigeration engineer. This is a very sensitive device and incorrect settings may create other failures.
High pressure drop	Excessive compressed air flow or too low air inlet pressure.	Check actual pressure and flow through the dryer.	This dryer is designed for a maximum air flow. If too much air is pumped into the dryer, water removal capacity may not be sufficient, resulting in liquid carry-over downstream. Check the rated flow of the air compressor.
	Freeze up	Check that compressor room ambient,	Frosting of the lines is an indication that controls are set too low. The following should be done by an experienced refrigeration technician.
		Fan switch could have failed in closed position keeping fan on.	Controls may be adjusted in the fields by means of the hot gas bypass valve. This is to be done by a qualified refrigerant technician.
The unit will not run or cycles off and on.	Clogged heat exchanger	Clean heat exchanger with reverse air flow.	Dryer are supposed to be used with compressed air free of any aggressive contaminants. Some contamination may require extra maintenance of the heat exchanger.
	Line disconnect switch is open.	Close the start or disconnect switch.	If the dryer is not operating, check the disconnect switch or circuit breaker to be certain it is on.
	Fuse or breaker is open	Replace fuse or reset breaker.	The fuse to the power line should be checked and replaced if needed. Never replace a burnt fuse with an oversized fuse.
	Faulty refrigerant compressor or controls.	Determine the cause and make correction	Failure of compressor to run may be caused by several factors. A qualified refrigeration specialist should check all electrical and refrigeration controls, or factory should be contacted if unit is in warranty.
	Excessive compressed air inlet temperature.	Design conditions and correction factors are described in this manual. Be sure that dryer is working in ambient temperatures below design conditions.	The dryer is designed for working into calculated design conditions. Should the conditions be exceeded, the dryer will be overflowed, dew point will go up and protecting devices may trip.

Problem	Possible Cause	Repair	Comments
The unit will not run or cycles off and on.	Excessive ambient temperature	Designed conditions and correction factors are described in dryer . Be sure that dryer is working lower than design conditions.	A high ambient temperature may cause the refrigerant system to operate at higher than normal pressures. Results will be a higher than normal evaporator temperature. Important: there should be adequate air circulation around the dryer, and proper ventilation in the equipment room should guarantee a low enough ambient temperature.
	Clogged condenser fins	Clear fins of all obstructions.	The clogged fins in the condenser will restrict the air passage and reduce the refrigeration capacity, causing high temperature in the evaporator. Fins should be periodically checked and cleaned.
	Shortage of refrigerant	Fix the leak and add a charge of refrigerant.	Loss of refrigerant will cause improper functioning. Dryers are equipped with a temperature switch which maintains the amount of refrigerant to maintain proper cooling of the compressor. A shortage of refrigerant may cause suction line to become very hot, causing the temperature switch to trip. A qualified refrigeration specialist should perform the necessary repairs.
Error sign occurs on digital temperature control device	The dew point is too low or too high	Check refrigerant gas and make sure that the working conditions are within the correct range.	If there is not enough refrigerant gas or if the working temperature and inlet temperatures are very high, the dew point will increase.
Drain Failure	Back pressure or reduction of drain port.	Back First of all replace the drain / drains. Open drain to atmosphere (no back pressure) - if hose / pipe is used to carry the drain somewhere else; keep or enlarge the diameter.	Max drain hose length after the dryer must not exceed 10 meters.
			Max drain hose height from the dryer must not exceed 3 meters.
			The drain port size should not be reduced.
			There should not be any fitting that may cause pressure drop such as valves, elbow, tees, etc. on the drain connection.
			Drain should be at atmospheric pressure at all times. Any back pressure will result in failure and malfunction.

## Refrigerated Dryer (MK-US) WARRANTY POLICY



When used under the conditions recommended by the manufacturer Mikropor, MK-US Dryer is warranted to be free from defects in material and workmanship for a period of twenty-four (24) months from date of receipt, not to exceed thirty (30) months from the factory ship date, provided Mikropor is furnished the customer's name, address, and date of shipment information.

The heat exchanger will be warranted for two (2) years. This warranty is limited to the replacement of the heat exchangers, F.O.B. Factory, and subject to the same restrictions as outlined below concerning misuse, abuse or accident. The standard equipment external float drain and optional automatic drain carry a 90-day warranty. This warranty will apply to equipment installed, operated and maintained in accordance with the procedures and recommendations as outlined in the owner's manual published by Mikropor during the life of this warranty, Mikropor will repair or replace (at Mikropor option) any defective part or assembly free of charge F.O.B. its warehouse if such defect occurred in normal service and was not due to apparent misuse, abuse or accident. This Warranty is not transferable. Any warranty service performed in the field must be authorized by Mikropor. Unauthorized service voids the warranty and any resulting charges will not be paid by Mikropor. Mikropor makes no other warranties or guarantees, expressed or implied. The merchantability of the components is expressly excluded. The manufacturer assumes no liability for indirect or consequential damages.