

Short Operating Manual

Retrofit Controller SU-ECH-C1/230/115(-PLUS)

Version: 1.1

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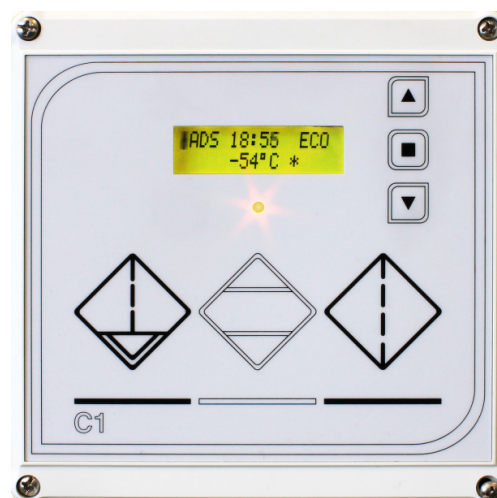
Date: 17.07.2012

1. For your safety



All the work in conjunction with the controller must only be carried out by qualified electricians!

Do not connect the controller to the supply voltage until all the electrical connections have been fitted completely!



1.1 Intended use

In general, the SU-ECH-C1/230/115 and SU-ECH-C1/230/115-PLUS retrofit kits and special the C1 controller included are used for indoor operation on adsorption dryers. For outdoor usage appropriate measures against rain and splash water, sunlight and frost have to be taken.

1.2 Scope of supply

- C1 control module with 2 x 16-character display (status and measured value indication)
- 4-wire cable harness with multiple cable gland and appliance connectors
- Self-adhesive points for controller box mounting
- Short operating manual

Provide additionally with "PLUS" version:

- SP-ESH420 pressure dew point transmitter
- PP-ESH420/08 dew point measuring chamber, preassembled with throttle and drain spiral
- Connecting cable with connector for pressure dew point sensor

1.3 Conversions and modifications

The controller and the dew point transmitter must never be electrically or mechanically modified! Any modifications may affect the operational safety and might lead to damages, and the warranty will be void.

2. Function description and application

2.1 Function

In principle, the C1 controller is used for controlling heatless regenerated and HOC (heat of compression) adsorption dryers of all manufacturers. This retrofit kit is designed for use on heatless regenerated adsorption dryers. The C1 system controls different valve configurations and control times. In addition to the control system and the mounting material the "PLUS" version contains a highly precise pressure dew point transmitter and a measuring chamber required for sensor operation. Compared to conventional dryer control systems considerable energy savings may be achieved by measuring and evaluating the pressure dew point and the resulting effects on the regeneration air behaviour.

Upon delivery, the control system has been parameterised, which means that additional settings for startup are not required.

2.2 Removing the old control system

- Depressurise the adsorption dryer. Make sure that no compressed air escapes unintentionally!
- Disconnect the supply voltage and secure it against unintentional reconnection.
- Disconnect the voltage supply line and pull off the appliance connector.
- Loosen the cable connections to the control valves, either
 - a) directly on, or in the old control system, provided that the cable harness is still operational and is to be reused, or
 - b) on the solenoid coils of the control valves, provided that the cable harness is to be replaced.
- Check if other built-on equipment or additional fittings, such as dew point measuring devices or cable connections to/from the control system need to be removed and reinstalled.
- Disassemble the old controller housing completely.
- Clean the mounting surface for new installation (oil-/grease-free), if necessary.

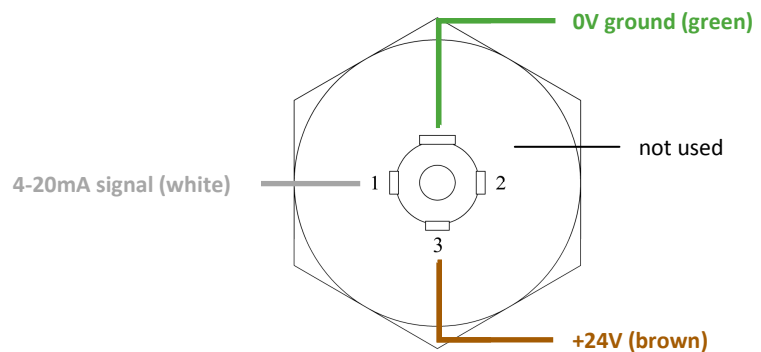
2.3 Installing the new control system

- Attach the adhesive mounting tape to the corners on the rear of the controller housing.
- Remove the second protective foil from the adhesive tape and fix the controller housing on the mounting surface of the old control system. Then press on tightly for some seconds.
- Insert the cable harness for the control valves in the centre bore using the cable gland. Alternatively, screw in the multiple cable gland only and lead the valve supply lines through the cable gland.
- Fix the valve connector plugs onto the solenoid coils and safely install the cable harness until reaching the control system housing, then tighten. Depending on the installation and device situation it may be necessary to fix/install the cable harness using additional cable ties and adhesive clamps.
- Shorten and strip the open ends of the valve supply lines in the control system. The length of the open line ends should be kept at 10 - 12 cm. The protective earth conductor should be 3 cm longer than the supply conductors.
- Install valve connections Y1 to Y4 to the terminal strip according to the wiring table in section 2.6.

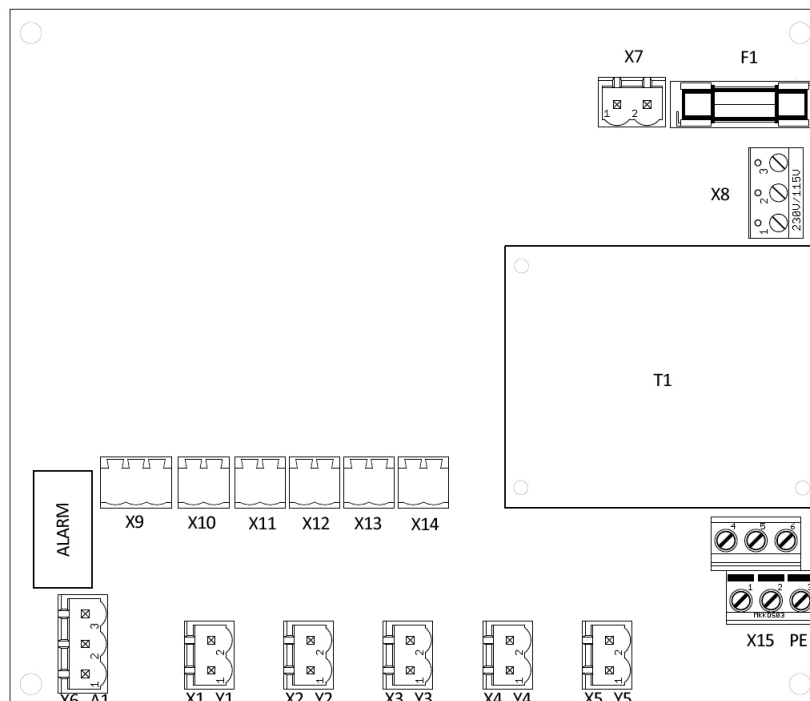
2.4 Installing the dewpoint transmitter

- The measuring chamber for the dew point transmitter is pre-assembled. The chamber is either fixed to an appropriate sample output for dry compressed air directly via the G 1/8 connection on the side or to the dryer (on the mounting plate) and supplied with dry compressed air using a fitting (not supplied as standard).
- On earlier dryers there may be an inspection glass containing an indicator filling. The measuring chamber can also be inserted at this point.
- Remove the protective packaging and insert the SP-ESH420 dew point transmitter and screw it into the measuring chamber. Turn and tighten the sensor via the hexagon only!
- Insert and tighten the connector of the pre-assembled cable.
- Lead the open cable end through the cable gland on the right into the control system. Safely install it to the dryer and shorten and strip, if necessary.
- Connect the cables to the X9 terminal strip according to the wiring table.

Top view of the
dew point sensor
electrical connections



2.5 Wiring diagram of the control system



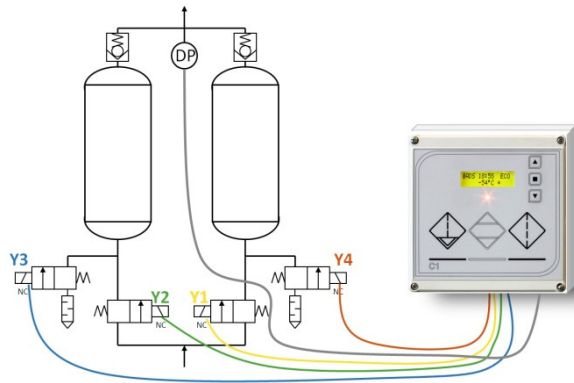
2.6 Wiring table

Terminal	Function	Connection	Cable connection
F1	micro fuse	500 mA, slow blowing	
X1	Y1 input valve left	1 Zero 2 Phase	
X2	Y2 input valve right	1 Zero 2 Phase	
X3	Y3 expansion valve left	1 Zero 2 Phase	
X4	Y4 expansion valve right	1 Zero 2 Phase	
X5	Y5 repressurisation valve	1 Zero 2 Phase	
X6	potential free alarm	1 N/C contact 2 Common 3 N/O contact	
X7	supply voltage 230/115 V AC	1 Zero 2 Phase	
X8	voltage jumper	1-2 jumpered = 230 V AC 2-3 jumpered = 115 V AC	
X9	dew point transmitter connection	1 GND/ground 2 SENSOR/signal 4-20 mA 3 +24 V DC	Green White Brown
X10	4-20 mA output	1 GND/ground 2 Signal 4-20 mA	
X11	IN 1 compressor synchronisation	1 GND/ground 2 Signal/N/C contact	bridge over 1-2 for normal operation
X12	IN 2 ext. dew point signal	1 GND/ground 2 Signal/N/C contact	Make sure that external contacts are potential free!
X13	IN 3 differential pressure of inlet filter	1 GND/ground 2 Signal/N/C contact	
X14	IN 4 differential pressure of after filter	1 GND/ground 2 Signal/N/C contact	
X15	PE connections	1-6 PE	Green / Yellow

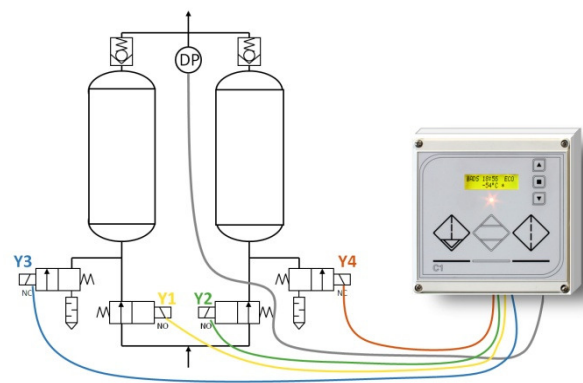
2.7 Startup

- Check if all the cable connections to the valves have been installed correctly. Follow the individual cables to the corresponding valve, if necessary.
- In the wiring table in section 2.6 connections X1 and X2 are wired for a dryer with normally open input valves. X1 and X2 will have to be exchanged (crossover) for a dryer with normally closed input valves.
- To ensure that the magnetic coils of the dryer are working properly it is recommended to check the cable for its resistance using an ohmmeter with the terminal strip removed. In this way, a short circuit or an open wire can be detected in time. The internal resistance of solenoid coils is between 1.5 kΩ and 6 kΩ.
- Plug on and tighten the mains plug using screws. Reconnect the supply voltage.
- Slowly fill compressed air into the dryer.
- For further information on the function and parameterisation of the C1 control system, please refer to the operating manual.

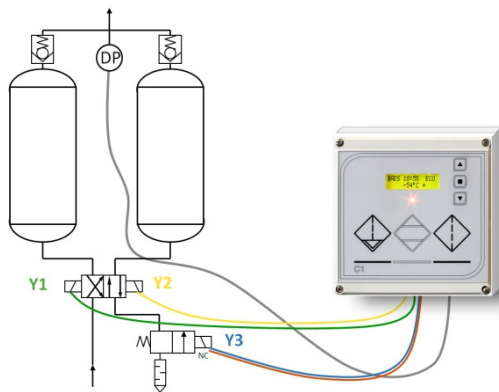
2.8 Connection examples for dryers with different valve components



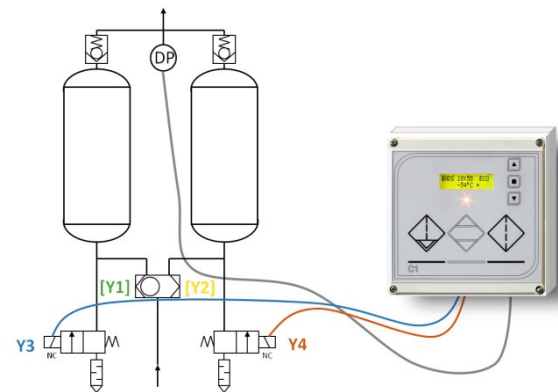
Example 1: 4-valve dryer with normally closed input valves



Example 2: 4-valve dryer with normally open input valves

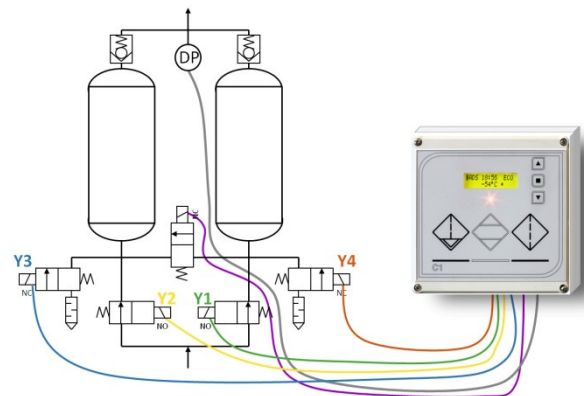


*Example 3: 3-valve dryer with 5/2-way shuttle valve and an expansion valve
For controlling the expansion valve outputs Y3 and Y4 are bridged.*



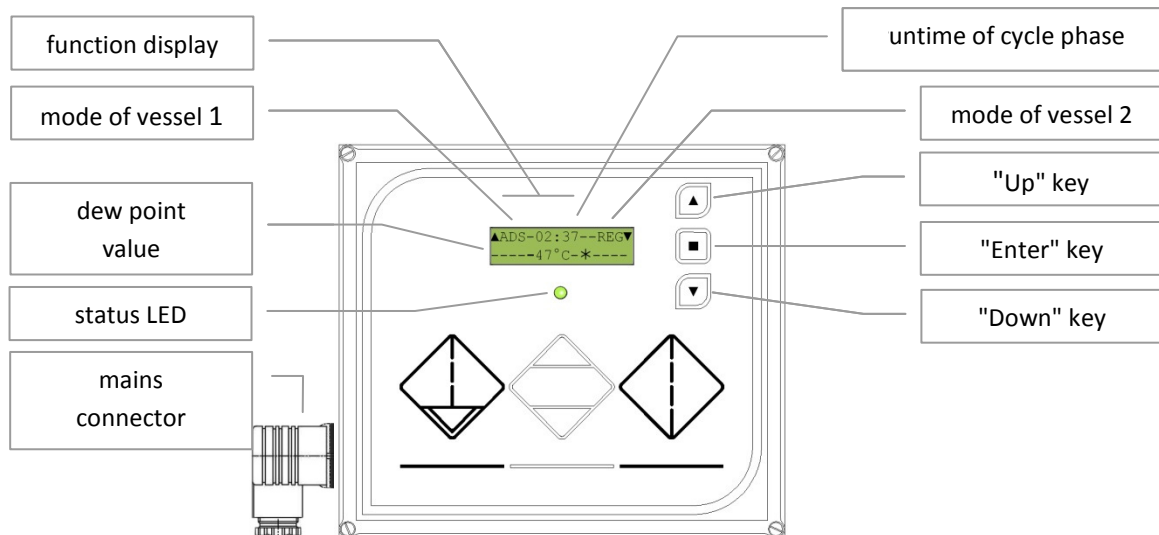
Example 4: 3-valve dryer with passive input shuttle valve and controlled expansion valves - control outputs Y1 and Y2 are not used

Example 5: 5-valve dryer with normally open input valves and repressurisation valve



3. Operating the control system

3.1 Function keys and display



The appliance connector is used to supply the C1 control system with the operating voltage. Following voltage connection the display will indicate the software version number for approximately 5 seconds.

The control system then immediately changes to the operating mode and starts in the program step at which it was last shut down. As a rule, all the operating states and settings are memory-resident, i.e. the control system will automatically continue the control program after a power failure.

The function display indicates all the relevant operating situations and the associated residual runtime and the pressure dew point*. After pressing a key the display backlight is on for 2 minutes. The status LED additionally informs you about the energy-saving mode and the alarm states.

Operation and entry of the setting values is carried out using the 3 keys. For further information, please refer to the menu structure. The language used for the control system is "easy" English.

Mode	Function	Display	Status
ADS	vessel adsorption	5:00 min - cannot be read	Input valves at vessel 1 or 2 opened
REG	regeneration	3:59 min - residual time indication	Expansion valves at vessel 1 or 2 opened
REP	repressurisation phase	0:59 min - residual time indication	Expansion valves at vessel 1 or 2 closed
CHG	vessel changeover	0:03 min - residual time indication	no valve activated
ECO	economy mode	xx:xx min - time indication	Expansion valves at vessel 1 or 2 closed
STB	standby mode	no time indication	Expansion valves at vessel 1 or 2 closed
LED	status indication		
Green	normal operation		
Orange	economy mode		ECO is indicated for one vessel
Red	alarm, flashing	message/dew point value	Acknowledge alarm manually via "Enter" key

3.2 Direct indication

Pressing the arrow keys allows for directly accessing additional information on the operating mode, energy savings and service monitor.

CYCLE MODE
VAR ECO 00:15:00



NEXT-SERVICE
82%

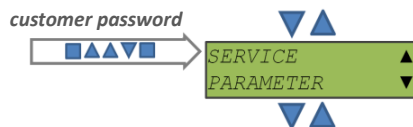
"Cycle Mode" indicates the VAR or FIX operating modes as well as the number of days, hours and minutes the dryer was in economy mode.

"Next Service" indicates the time (as a percentage value) remaining for the next service message to be shown. This value depends on the actual utilisation of the dryer. For this value, the pure operating hours are counted which the dryer used for regeneration. Depending on the operation intensity the time for the percentage value = 0 and the service message to be shown may be different.

3.3 Menu guide

Access to the menu structure and thus to the parameter settings is generally password-protected against unauthorised access. Keep this operating manual in a safe place and make sure it is available for maintenance.

The password is:



The menu is structured in two paths. Pressing the "Up" arrow key selects the service section. Pressing the "Down" key selects the parameterisation section.

Pressing the "Down" key selects the corresponding menu item. Pressing the "Enter" key opens the parameterisation level. On this level, the setting value can be changed using the "Up" and "Down" keys. Confirm the settings entered using the "Enter" key. The display returns to the menu item.

The numeric codes in the service section are also set using the arrow keys. When entering a digit the cursor jumps to the next position until the code has been entered completely.

3.4 Parameter settings

The table shows all the parameters, their default settings and their function.

Menu	Default settings	Value range	Function
CYCLE MODE	VAR	FIX VAR	In FIX mode the control time program is executed without being affected. VAR mode provides the energy-saving function. Internal dew point measurement or an external signal (IN2) will affect the control time.
CYCLE STOP	FINISH CYCLE	FINISH CYCLE DIRECT STOP	When opening the compressor synchronisation contact in DIRECT STOP mode the expansion valves open immediately and vessel change will be prepared. In FINISH CYCLE mode the regeneration cycle started will be completed. Please note that the dryer still requires compressed air for this purpose! <i>See also compressor synchronisation.</i>
PDP SET	-40°C *	20°C * to -100°C*	Threshold value for dew point control.
PDP ALARM SET	-25°C *	20°C * to PDP SET	Threshold value for dew point alarm.
PDP SENSOR	ON	ON OFF	Switches internal dew point measurement on/off.
PDP DISPLAY	ON	ON OFF	Switches dew point value indication on/off (4-20 mA signal at X10 is not affected).
ALARM PDP	ON	ON OFF	When ON, the dew point alarm controls the alarm relay. When OFF, the relay is not controlled.
PDP ALARM DELAY	00:10 s	00:00 .. 20:00	Alarm relay control can be delayed for up to 20 minutes. In the event the dew point alarm falls again within the delay time, the alarm relay will not be switched.
TEMP UNIT	°C	°C (degrees Celsius) °F (degrees Fahrenheit)	Changes the temperature indication.
ALARM FILTER1	OFF	ON OFF	Input IN3 can be used to evaluate the threshold switch of a differential pressure gauge on the upstream filter. The result can be indicated in the form of an alarm.
ALARM FILTER2	OFF	ON OFF	Input IN4 can be used to evaluate the threshold switch of a differential pressure gauge on the downstream filter. The result can be indicated in the form of an alarm.
FILTERALARM DLY	00:20 s	00:00 .. 20:00	Delay time for the filter alarm up to 20 minutes. This function can be used to suppress alarm activation caused by rapid volume flow changes (peaks).
ALARM OVERFLOW	OFF	ON OFF	"Overload" of the dryer can be detected by simultaneously monitoring the differential pressure monitors on the upstream and downstream filters. An overflow alarm is activated when the signals from IN3 and IN4 are present during the alarm delay time.

3.5 Compressor synchronisation function

The CYCLE STOP menu item is used to select the control system behaviour for the signal at the digital input IN1. By default, IN1 (terminal X11 on the board) is provided with a jumper for normal operation. If the jumper is opened, the control program goes into standby mode. There are two options:

CYCLE STOP ▲
DIRECT STOP ▼

In DIRECT STOP mode the control system is stopped immediately and outputs Y3 and Y4 are not (no longer) controlled. All the time values expired until then will be "frozen" (stored).

CYCLE STOP ▲
FINISH CYCLE ▼

In FINISH CYCLE mode the control system will only be stopped after completing the regeneration cycle, and outputs Y3 and Y4 are not (no longer) controlled. All the count values will also be "frozen".

Independent of the type of cycle completion "STB" is indicated for both vessels on the display.

Example: IN1 can be connected to the auxiliary contacts of a compressor. This synchronises the dryer with the compressor. The dryer only regenerates with compressed air being produced. The influencing compressor synchronisation contact does not affect the input valves. The compressor synchronisation contact can also be used as a remote switch and can, for example, be connected to higher-level time or emergency control systems.

3.6 Dew point measurement and energy-saving function

If the internal dew point measuring system is used with a pressure dew point sensor or if an external measuring instrument is used with a 4-20mA signal output, it must be registered to the control system. For this purpose the option in the PDP SENSOR menu must be set to ON.

PARAMETER ▲▼ PDP SENSOR ▲▼
PDP SENSOR ■ ON ▼

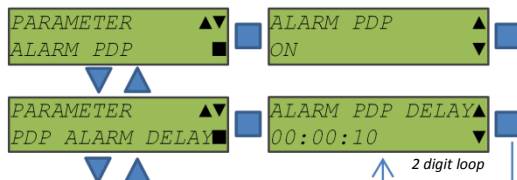
The working point of the dryer is specified by the dew point threshold value. It can be set in the PDP SET menu using the arrow keys. The default setting is -40°C *.

PARAMETER ▲▼ PDP SET ▲▼
PDP SET ■ -40 °C * ▼

Every time the dryer is not operating at the performance limit (i.e. at maximum volume flow rate), a better (lower) pressure dew point value can be achieved than specified by the threshold value set. The dryer then switches to the ECO mode and delays the next vessel change or regeneration phase until the measured dew point value exceeds the threshold value. For information on the total time the dryer was in ECO mode, please use the direct indication method and refer to 3.2.

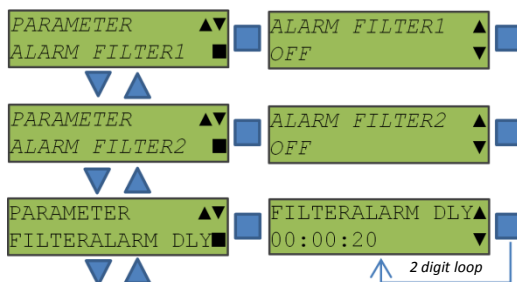
PARAMETER ▲▼ PDP ALARM SET ▲▼
PDP ALARM SET ■ -25 °C * ▼

The dew point alarm is preferably set with a distance of 10° to 20° to the dew point threshold value. This prevents hypersensitive reactions of the alarm messages from occurring. Spontaneous fluctuations of the measured dew point value caused by pressure or load variations within the system are inevitable. Direct activation of the dew point alarm sensor in the event of dew point peaks can also be suppressed by setting a longer delay time. This rule applies: For the entire delay time the measured dew point must be worse than the alarm value set.



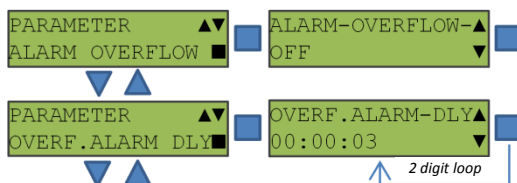
3.7 Filters for differential pressure monitoring

The pre- and after-filters of an adsorption dryer can optionally be provided with differential pressure gauges with an integrated differential pressure monitoring contact. Using the C1 control system the contact signals can be separately evaluated and indicated for the upstream and downstream filters. The connections are provided via switching inputs IN3 and IN4. You can individually switch the alarms on or off and delay their evaluation.



3.8 Overflow monitor

If the pre- and after-filters are provided with differential pressure monitors (as described in 3.7), the overflow can be evaluated by means of common interrogation of both contacts. It can be assumed that the dryer will be strongly overloaded (internal flow rates too high), if the differential pressure monitors on the upstream and downstream filters are activated simultaneously.



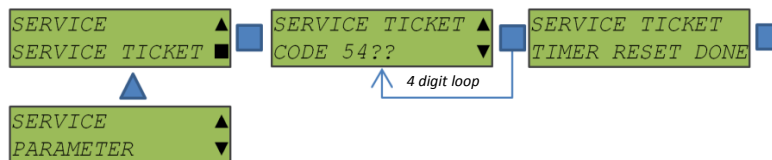
The ALARM-OVERFLOW monitor is switched off by default. The delay time should always be shorter than the delay time of the separate differential pressure monitor on the filters.

3.9 Service ticket

The control system program counts the switching cycles of the dryer. This allows for representing the vessel load changes on the one hand and for calculating the actual capacity utilisation or the desiccant and upstream/downstream filter wear using the count values in relation to the duty cycle on the other hand. After reaching a threshold value (66,400 complete load changes (corresponds to approx. 1 year) under normal operating conditions) a service warning message is indicated.

To acknowledge the service warning message a 4-digit numeric code ("service ticket") must be entered. Every time buying service parts and filter elements the customer is provided with a new service ticket including the numeric code. Once a numeric code has been used it cannot be entered again. Upon indication of the next service warning message the control system expects a new code to be entered.

The path for entering the service parameters and monitoring functions can be accessed by entering the password and pressing the "Up" arrow key.

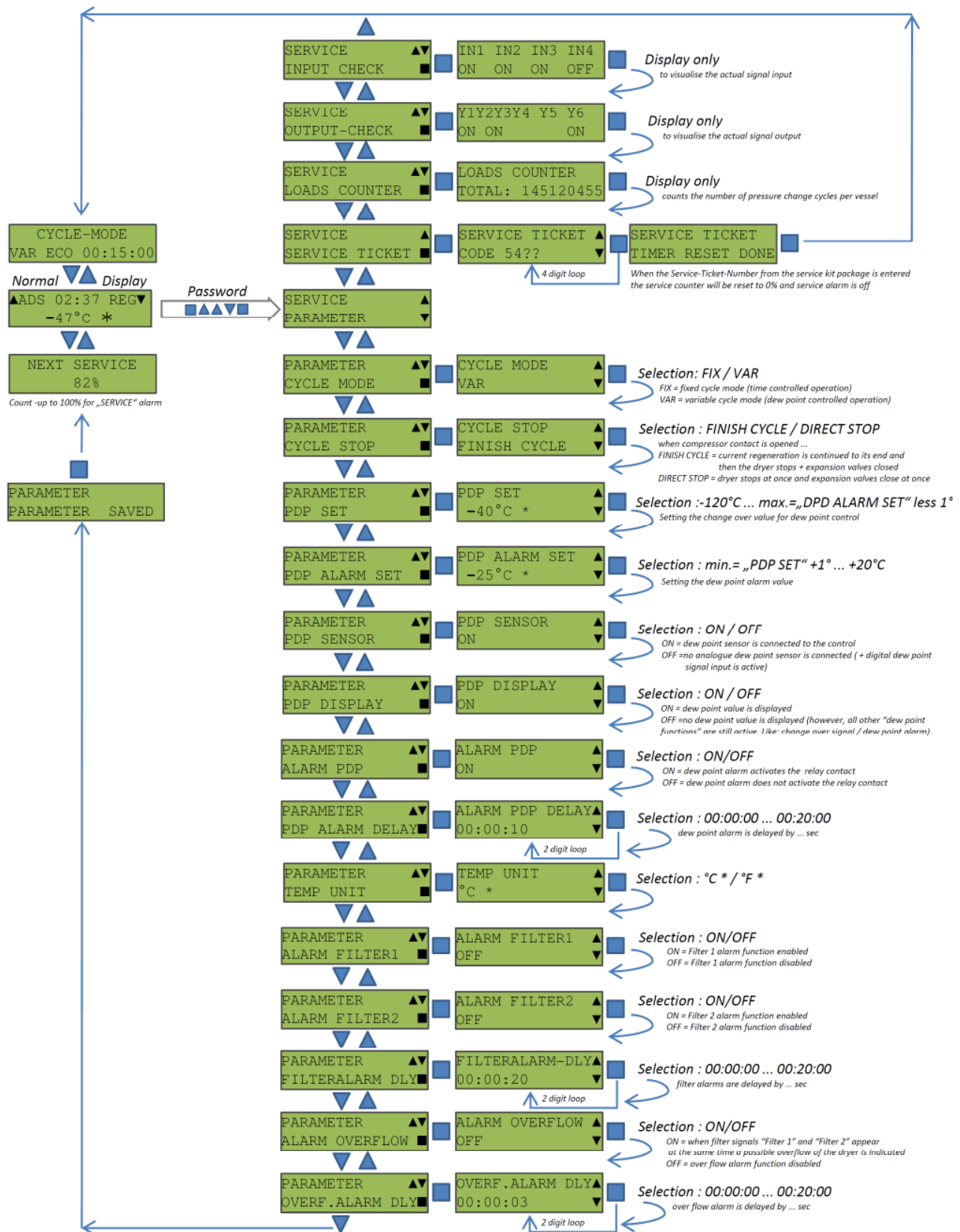


The number of the ticket code is entered digit by digit using the arrow keys. The cursor moves to the next digit by pressing the "Enter" key.

When the correct ticket code has been entered *TIMER RESET DONE* is indicated. When the wrong code has been entered *TIMER RESET FAIL* is indicated.

If the ticket code has not been entered correctly, it can be entered again after approximately 2 minutes. If, after this try, the ticket code is not entered correctly again and again, the waiting time for the next try doubles each time until the correct code is entered.

3.10 Menu structure



4. Error analysis table

Error	Cause	Measure
Control system not ready to operate / LED not on	Voltage supply missing	Check voltage supply and switch on, if necessary.
	Appliance connector installed incorrectly	Check cable connections on appliance connector.
	Fine-wire fuse defective	Replace fine-wire fuse (500 mA, slow-blowing).
Valve not working	Cable connection to magnetic coil defective	Check cable connection and reinstall, if necessary.
	Magnetic coil defective	Check magnetic coil using ohmmeter.
	No voltage at valve output	Switching transistor of output may be defective.
No dew point value on display	Sensor not registered	Register pressure dew point sensor to control system, see 3.6.
Indication ALARM SENSOR	Sensor cable connected incorrectly	Remove contact problems and check wiring, see table 2.6, X9.
	Sensor defective	Check dew point sensor and send it back to be inspected, if necessary.
	Too much moisture in sensor	The sensor was in contact with splash water. Dry the sensor slowly. Never dry the sensor using compressed air!
Dew point indication ---°C *	Signal of dew point transmitter below 4mA	Indicates heavy dirt accumulation on the active sensor surface. The sensor has to be replaced.
	Signal of dew point transmitter below 4mA	4-20mA signal adjusted incorrectly during connection of external dew point measuring instruments.
Dew point indication +++°C *	Signal of dew point transmitter above 20mA	Active sensor surface is very moist and must be dried carefully.
	Signal of dew point transmitter above 20mA	4-20mA signal is adjusted incorrect. Check measuring range of external dew point measuring instruments. Cable connections from/to sensor are inverted.
Dew point indication incorrect	Possible only if external dew point measuring instruments are connected. Default scaling of 4-20 mA signal not matching.	Adjust 4-20mA scaling (by manufacturer service only). Set 4-20mA output of external measurement system.
Indication ALARM FILTER	Differential pressure monitor has been triggered	Acknowledge alarm using "Enter" key.
	Cable connection from/to differential pressure monitor defective (open)	Check cable connection from control system using a continuity tester. In normal state the contact loop needs to be closed.
Indication ALARM OVERFLOW	Differential pressure monitor has been triggered. Upstream and downstream filters have been triggered simultaneously = dryer has been over-loaded.	Acknowledge alarm using "Enter" key. Frequent overloading of the dryer considerably damages the desiccant.
Indication ALARM DEWPOINT	Dew point value above the alarm value	Acknowledge alarm using "Enter" key. Dew point alarms occurring more frequently after some years of operation indicate that the desiccant capacity is exhausted.
Indication ALARM 24VDC	Internal monitoring function of the control system has been triggered	Disconnect control system from voltage and restart after approx. 30 seconds. Contact manufacturer service in the event the control system fails to restart.

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Error	Cause	Measure
Dryer switches over without pressurisation phase (one side or two sides)	Supply lines of input valves and expansion valves mixed up	Check installation according to table in 2.6 and diagram in 2.5.
Expansion noise of dryer is too loud and, at the same time, there is pressure loss in the system	Supply lines of input valves V1 and V2 mixed up	Check installation according to table in 2.6 and diagram in 2.5. Try to change the connections, if necessary.