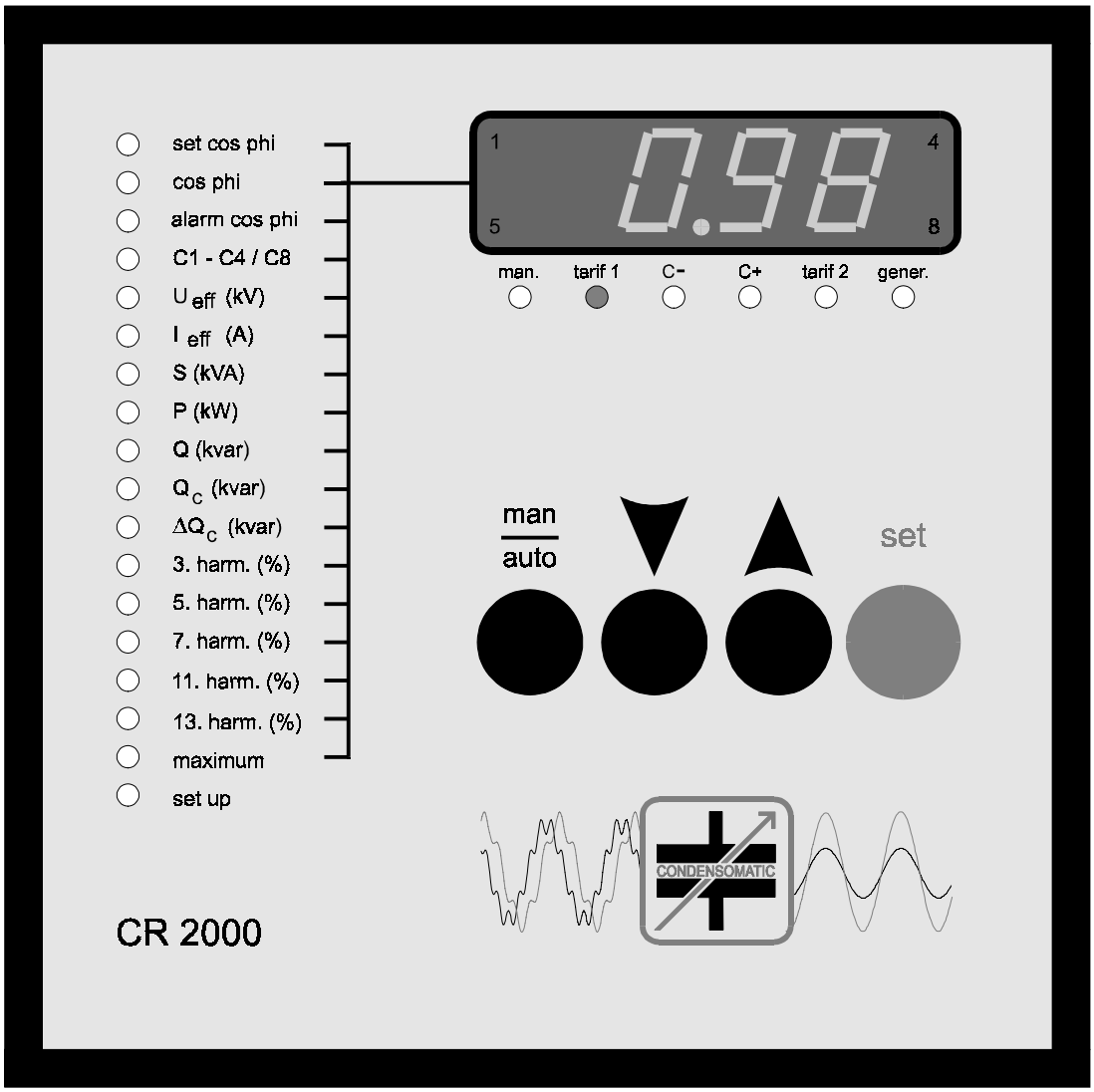
Operating manual

CONDENSOMATIC 2000



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1. Safety advices

Mounting, connection, setting into operation and repairing of the power factor regulator CONDENSOMATIC 2000 are only allowed to qualified personnel. The valid legal and safety regulations have tp be obeyed.
Die Bedienungs- und Sicherheitshinweise sowie die technischen Angaben in dieser Bedienungsanleitung und auf dem Typenschild sind zu beachten.

In the case of visible damages or if any invisible damage has to be assumed due to faulty operation or surrounding conditions, the regulator must not be installed or put into operation, that means it has to be stopped immediately.

The regulator works with mains voltage and must not be opened.

The switching outputs are alive in switched off condition, too.

Additionally the safety advices and the operating manual of the power factor correction equipment have to be considered.

2. Features

The power factor regulator CONDENSOMATIC 2000 is designed for application in automatic power factor correction equipments for the load-depending control of power capacitors by means of special capacitor contactors.

After putting into operation the regulator determines the kind of connection. This makes the connection to any phase and any current direction possible. The connected capacitor powers are determined by trial switchings. They are continuously surveyed and corrected during operation.

The CONDENSOMATIC 2000 uses a 4-quadrant measuring system and calculates load-depending the rerquired capacitor power to reach the programmed target-cosphi. This is obtained by swichting on and off specific capacitor steps. The load-depending calculation of the switching time and the equal distribution of switchings and operating hours on capacitor steps of equal power minimizes wear and load of the supply system.

The displaying of all important data of the supply system and the power factor correction equipment offers good overview on the situation in the supply system at all times.

The continuous surveillance of data of supply system and power factor correction equipment together with alarms and, if needed, switching off of capacitor steps gives safety against disturbances and overload conditions.

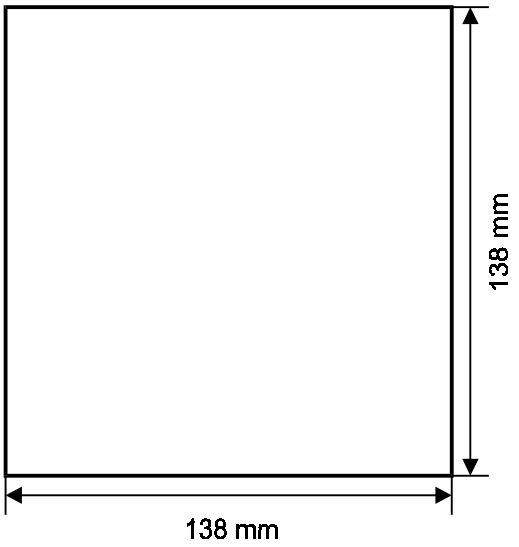
The CONDENSOMATIC 2000 is equipped with an output for external alarm signalling and with an input for tariff switching (optional for CR2000B).

Optional a RS485-interface for communication with the remote control unit FK2000 or a PC is available (not CR2000B).

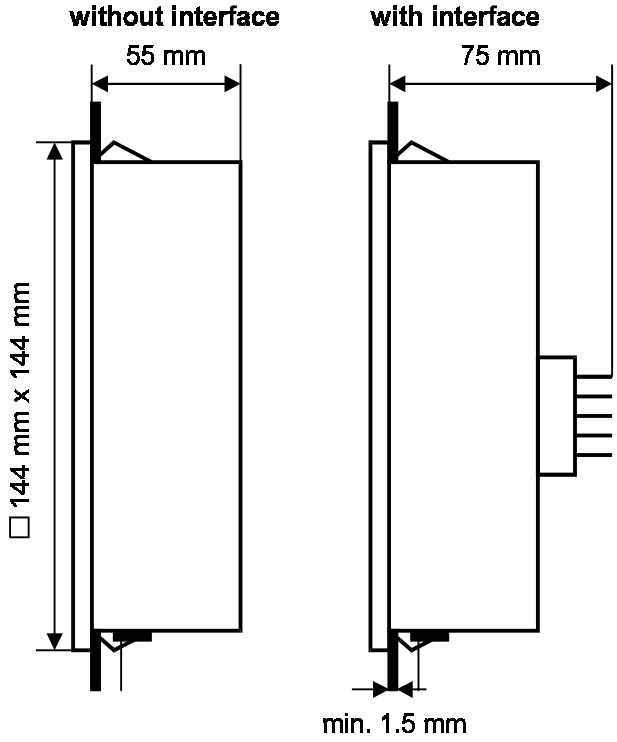
3. Mounting and installation

The power factor regulator CONDENSOMATIC 2000 is equipped with a case for switchboard mounting according to DIN 43700. The fixing is done with the preassembled panel clips or optional by mounting on a DIN-rail.
The scope of delivery includes pluggable connection blocks for connection.

3.1 switchboard cut



mounting depth



3.2 Connection

The connection of the CONDENSOMATIC 2000 is done with a pluggable connection block. During the installation the technical information on data sheet and rating plate have to be compared with the data of the supply system. Before disconnection of the connection block, all terminals must be checked to be dead and all measuring current circuits have to be bridged.

3.3 Operating voltage

Th e connection of the operating voltage U_B is made to the terminals 8 and 9. The operating voltage is 230 V / 50 - 60 Hz, if no other rating is given on the rating plate, and has to be fused with a maximum of 4 A.

3.4 Measuring voltage

The measuring voltage U_M has to be connected to the terminals 1 and 3. It is allowed to be between 58 and 690 V at 50 - 60 Hz. It can be taken from one phase and the neutral conductor (standard connection) or between two phases. All phases have to be fused with max. 4A.

3.5 Measuring current

A suitable current transformer has to connected to the terminals 6 and 7 of the measuring current input. It has to be mounted in one of the outer conductors before all loads and the capacitor bank. The connection of the current transformer terminals S1 (k) and S2 (l) to the terminals of the regulator without any special relation.
If several current transformers are connected to a summation transformer, it has to be considered, that these have all the same current transformer ratio or that a special summation transformer has to be used.
If a current transformer with a different transformer ratio is mounted after a complete putting into operation, or if any change has been made to the connection, then a reset of the regulator and a new putting into operation is required.

3.6 Switching outputs

The operating voltage for the contactors (max. 250 V / 50 - 60 Hz) is connected to terminal 12 of the regulator. It has to be fused with max. 4A. The connection of the contactor coils is made to terminals 13 - 16 for regulators with 4 swichting outputs and to terminals 13 - 20 in the case of 8 switching outputs (see rating plate).

The CONDENSOMATIC 2000 is equipped with zero voltage tripping, that switches off all outputs, if the operating voltage breaks down for more than 15 ms. This avoids damage to contactors and capacitors. This protection is only efficient, if the operating voltage for the contactors is connected to the same phase as the operating voltage of the regulator.

The smallest capacitor step has to connected to output 1 (see also: hints for switchboard builders).

3.7 Alarm output (CR 2000, optional for CR 2000B)

The potential free alarm output contact can be loaded up to 250 V / 2 A. The contact is closed in case of alarm or missing operating voltage and it is opened in normal operation.

3.8 Tariff switching input (CR 2000, optional for CR 2000B)

The potential free tariff switching input is controlled with operating Voltage U_B and has to be protected with a fuse of max. 2 A.
If there is no input signal , then tariff 1 is active, otherwise tariff 2 is active.

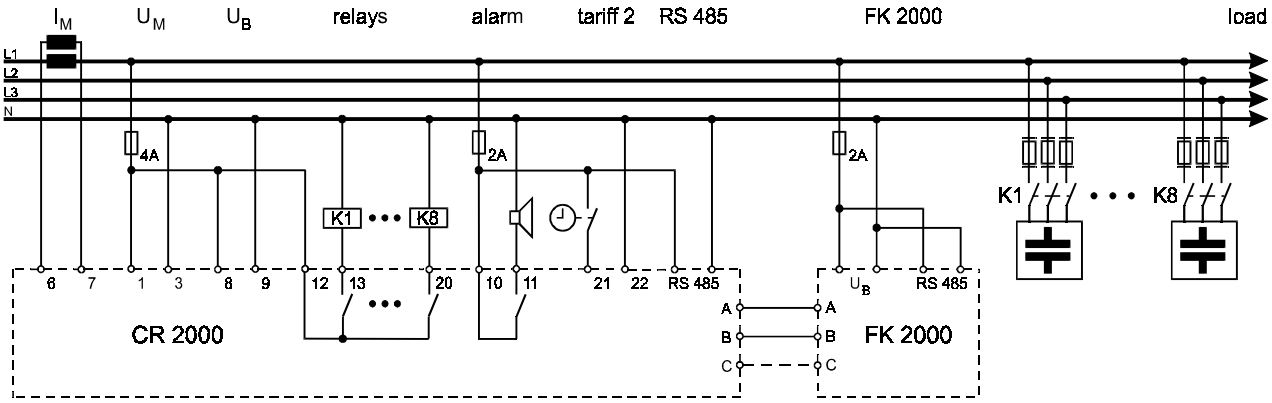
3.9 RS485 interface (only CR 2000 with option S)

The optional interface operates according to the RS485 standard and offers a half-duplex connection at a RS485 line with a maximum of 32 instruments at one line.

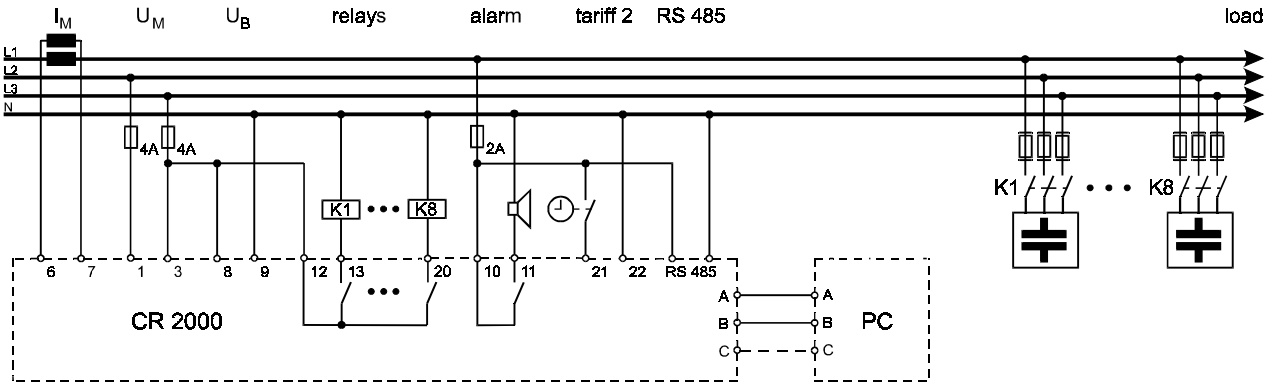
The interface has to be connected to the operating voltage at its connector block.
The line has to be carried out with a screened wire, the screen has to earthed on one end. Both ends have to be terminated (approx. 100 - 150 ohms). The maximum line length is 1200 meters under ideal conditions.

4. Wiring diagrams

4.1 Standard connection (measuring voltage phase - neutral conductor)



4.2 Alternative connection (measuring voltage phase - phase)



5. Hints for switchboard builders

5.1 Power graduation

The intelligent control and the possibility of any power graduation meets all requirements for an effective reactive power compensation with minimized wear, even with 4 or 8 switching outputs. Also equipments with small capacitor steps are possible. As an example, the power graduation 1:2:4:8:16:16:16:16 allows 15 respectively 79 steps without problems. Practical experience shows that power factor correction equipments should be controlled in 6 to 20 steps.

The CONDENSOMATIC 2000 realizes an evenly distribution of wear to all capacitor steps. The greatest effect is obtained with power graduations, that include different groups of at least two equal capacitor steps.

Examples:

12.5 : 12.5 : 25 : 25	= 75 kvar in 6 steps
12.5 : 12.5 : 25 : 25 : 25	= 100 kvar in 8 steps
25 : 25 : 50 : 50 : 50 : 50	= 250 kvar in 10 steps
25 : 25 : 50 : 50 : 75 : 75	= 300 kvar in 12 steps
25 : 25 : 50 : 50 : 75 : 75 : 100 : 100	= 500 kvar in 20 steps

5.2 Smallest step

The smallest step power should be connected to the first output of the CONDENSOMATIC 2000, because this power determines the sensitivity of control. Beyond this all steps must fulfill the following condition:

The step power in kvar, divided by the current transformer ratio and the voltage transformer ratio, must be equal or greater than 0.05. At other voltage levels than 400V this value must be multiplied with following correction factor: 440V: 0.907, 525V: 0.76, 690V: 0.575

Example 400V:

25 kvar / (2500/5 x 1) = 25 kvar / 500 = 0.05 step power is great enough

Outputs with too small capacitor powers are determined as not used and therefor excluded from further control.

6. Display and LEDs

Mean part of the display is the four digit display on the regulators front. It shows measured values and displays alarm messages. It also shows the switched on outputs.

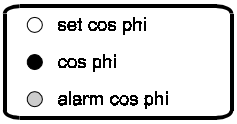
CR 2000:

The menu list on the left with its LEDs shows, which value with which unit of measure is currently displayed. The LEDs „maximum“ and „setup“ flash, if the maximum or the setup menu is actibe instead of the main menu. At displaying and programming of cos j - values, the LEDs „tarif 1“ oder „tarif 2“ show, to which tariff the currently display value belongs.
The LED „man“ lights only during the manual operating mode.
In the automatic mode „C+“ and „C-“ show the switching tendency. Additionally „C+“ flashes, if the switching of an output is delayed because of internal dead times after power on and in the manual mode.
The LED „gener.“ signals whether active power is consumed from or delivered to the supply system, independent of the operating mode.

CR 2000B:

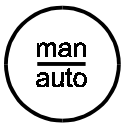
On the left side of the front the menu items „F01“ to „F13“ are listed together with the corresponding units.. The display content is frequently altered between the menu item and the corresponding value. When showing cosj values for tariff 2 the last decimal point „tarif2“ is switched on.
The first two vertical bars in the display („C+“ and „C-“) show the tendency of switching during automatic mode while the actual cosj is displayed.

Display and LEDs are shown as follows:

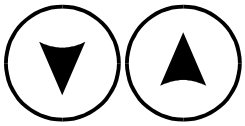


the LED „set cos phi“ is dark,
„cos phi“ lights continuously,
„alarm cos phi“ flashes

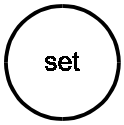
7. Keyboard functions



The key **man** toggles between automatic and manual operating mode. If it is hold for more than 3 secondes when entering manual mode, all outputs are switched off.



The arrow keys **down** and **up** used for choosing menu items and for altering programmed values.



With the **set** key settings are altered and saved, maximum and setup menu are activated and deactivated. In the maximum mode it erases stored maximum values. Steps are switched on and off with this key in the manual mode.

Pressing more than one key at a time has no effect.
Holding all four keys for more than 5 seconds carries out a reset with putting to operation.

8. Putting into operation

8.1 Putting into operation under standard conditions

The CONDENSOMATIC 2000 requires only one key press for putting into operation under standard conditions. In all cases the following conditions have to be fulfilled before putting into operation:

- The reactive power compensation equipments must be ready for operation.

- The measuring current must be equal or greater than 20 mA, all bridges must be opened.

Your equipment meets the standard conditions, if:

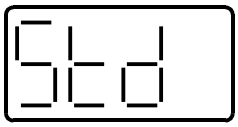
- The measuring voltage is taken from one phase and the neutral conductor.

- Inductive load is present (cos j between 0.40 and 0.99 inductive).

- active power is consumed from the supply system (no generator operating).

If one of these points is not fulfilled, go on with chapter „Putting into operation under special conditions“.

Switch on the operating voltage of the CONDENSOMATIC 2000.



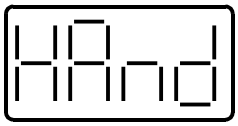
The regulator starts displaying „Std“. Press the **set** key.

The display shows „CALC“ and the regulator determines the connection of measuring voltage and current. After successful completion the determination of the capacitor powers is carried out by switching on and off all outputs for few times, always obeying a blocking time of 30 seconds. This can take up to 12 minutes.

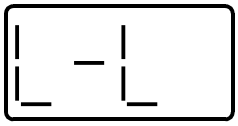
During the determination of capacitor powers the actually tested step is displayed by lighting the corresponding display segment. After ending this calibration the regulator starts automatic control and displays the actual cos j.

After this calibration the reactive power compensation equipment is in the automatic operating mode.
For displaying the current and the powers as primary values, the current transformer ratio is needed and therefor it should be programmed next.
Only in installations with the measuring done on the medium voltage level, the voltage transformer ratio is also required.

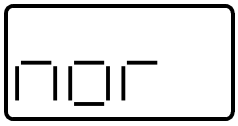
8.2 Putting into operation under special conditions



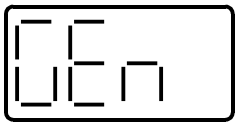
If the connection diverges from the standard connection or if there is a special situation in the supply system the puuting into operation is carried out as follows. After switching on the operating voltage the regulator displays „Std“. Do not press **set**, but change the display content to „HAnd“ using the arrow keys.
Press **set** for confirmation.



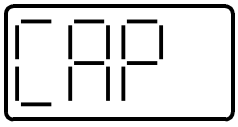
Now choose and confirm the kind of connection, phase-neutral conductor („L-n“) or phase-phase („L-L“)..



The operating conditions in the supply system, that means consumtion or delivery of energy, are asked next. For consumption choose and confirm „nor“.



If you have a generator running and delivering energy, than choose „GEn“.

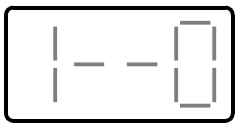


The last point is the programming of the actual supply system situation. Choose („ind“), if the system is inductive or („CAP“) for capacitive. In both cases a cos j between 0.4 and 0.99is allowed.

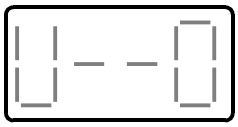
After confirmation of the last point the calibration is done, displaying „CALC“, similar to the standard connection.

8.3 Alarm messages during putting into operation

During putting into operation the measured values are checked. If they exceed their limit or if parts of the calibration can not be completed successfully, than one of the following alarms is displayed.



The measuring current is lower than 20 mA. Check the connection, the line and all present bridges. Make sure that the current transformer is not mounted in the feeding line of the compensation equipment. If necessary, switch on suitable load. If the fault condition is removed, the regulator continuous with the calibration automatically.



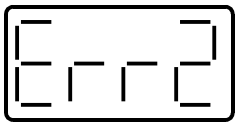
The measuring voltage is lower than 50 V. Check the connection and all fuses. Calibration is continued when the voltage returns.

The automatic detection of the connection failed. The following causes are possible:

- The situation in the supply system does not meet the setting chosen during putting into operation. Start again with correct settings by resetting the regulator or interrupting the operating voltage.

- The actual cos j is not within 0.4 and 0.99, switch on or off suitable loads.

- The supply system is not calm enough, especially when changes between inductive and capacitive appear. Switch off rapid switching loads or start again later, when the situation is better.

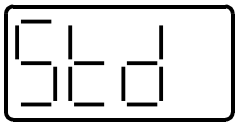


The CONDENSOMATIC 2000 was not able to detect the capacitor power of the first output respectively the capacitor power is too small.

- Check all fuses and the equipment being ready for operation.

-Make sure, that the current transformer has not been mounted behind the reactive power compensation equipment.

- If the step power is too small (see also: hints for switch board builders), then a current transformer with smaller ratio has to be mounted or the step power has to be increased (ask your supplier of the reactive power compensation equipment!).



Start putting into operation again by pressing the set button.

8.4 Reset

After repairing capacitor steps with preceeding fault message, after extension of the capacitor bank, after changes of the connection and after changes of the current transformer ratio a reset with new calibration has to be carried out.

For this all four keys must be hold for at least fine seconds.
The CONDENSOMATIC 2000 starts as described in chapter 8.1.

9. Displayed values and settings

9.1 Main menu

The main menu includes the displaying of the network data and the harmonics, the step display, the settings of target- and alarm-cos j, the programming of the harmonics limit and the menu items for choosing maximum- or setup menu.
The arrow keys allow choosing the menu item.

CR 2000:

The LED column on the left shows the active menu item with unti of measure. The LEDs for target- and alarm-cos j are used twice. The LEDs „tarif 1“ and „tarif 2“ signal to which tariff the actually displayed value belongs.

CR 2000B:

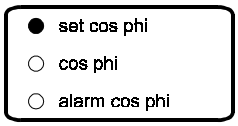
The list on the left shows all available menu items. The number of the menu item (e.g. „F02“ for the actual cosj) alters with the corresponding value . If the last decimal point „tarif2“ lights, the actual displayed value belongs to tariff 2, otherwise to tariff 1.

9.1.1 Settings

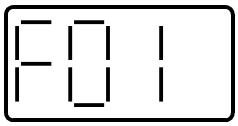
For alteration of a setting the corresponding menu item is chosen and the programming mode is activated with the **set** key. The actual value flashes and can be changed with the arrow keys. Values with wide range, e.g. the current transformer ratio, are programmed character after character. The changed value i sstored with **set** and the programming mode is left.

9.1.2 Target-cos j

CR 2000:



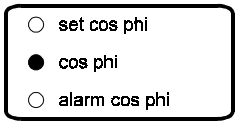
CR 2000B:



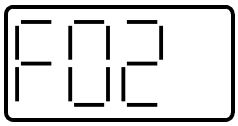
In the automatic mode the CONDENSOMATIC 2000 tries to reach this cos j by switching on and off specific outputs.The target-cos j is programmed separately for tariff 1 and tariff 2 under the menu item „set cos phi“. The limits are 0.80.inductive and 0.80 capacitive. If the target-cos j is programmed lower than the corresponding alarm-cos j, this one is corrected automatically.
This value should be set to 1, if not otherwise noted in the energy supplier´s regulations. Alarm is signalled, if the alarm-cos j cannot be reached. The target-cos j has no effect on this.

9.1.3 Cos j

CR 2000:



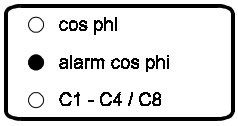
CR 2000B:



This menu item shows the actual cos j. Simultanuously the LEDs „tarif 1“ and „tarif 2“ specify the actual tariff. This is controlled by the tariff switching input. The type CR 2000B indicates only tariff 2 with the last decimal point.

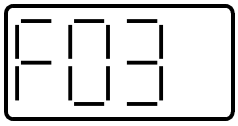
9.1.3 Cos j

CR 2000:

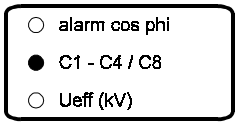


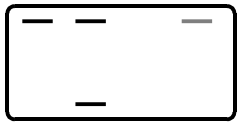
If this value could not be obtained, although all available outputs have been switched on or off during the programmed alarm time, this is indicated in this display and alarm output is closed (optional for CR 2000B).

CR 2000B:



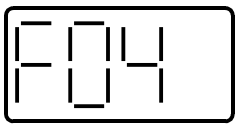
9.1.5 Step display





This shows all switched on and defective capacitor steps. Every output has a corresponding display segment, on the upper border for the outputs 1 - 4 and on the lower border for the outputs 5 - 8 (see printed characters on the front). The segments flash for outputs with missing power or total fault.
The example shows the outputs 1, 2 and 6 being switched on and the output 4 being defective.

CR 2000B:

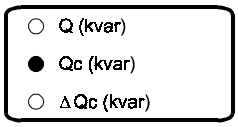


9.1.6 Network data

Under the menu items „U_{eff}“ to „DQ_C“ the CONDENSOMATIC 2000 shows the measured and calculated network data. These are secondary values, if current transformer ratio and voltage transformer ratio are set to 1. If the current transformer ratio, and in installations with measurement on the medium voltage level also the voltage transformer ratio, are set correctly, then the se are considered and the primary values are displayed.
Alle powers are calculated for a three-phase system.
The following menu items are explained as examples.

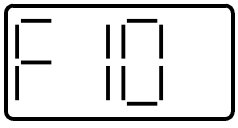
9.1.7 Switched on capacitor power

CR 2000:



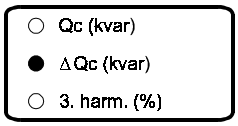
Under the menu item „Q_C“ the currently switched on capacitor power is displayed, considering the actual mains voltage. The maximum value is stored and can be displayed in the maximum menu (not CR 2000B).

CR 2000B:



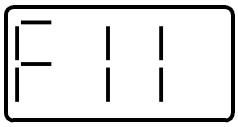
9.1.8 Missing capacitor power

CR 2000:



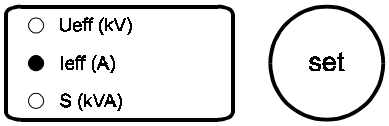
This item shows the capacitor power, that is missing for reaching the programmed target-cos j. In the case of all outputs being switched on and still capacitor power missing, the maximum is stored. This maximum is a help for the determination of the required power for extensions.

CR 2000B:

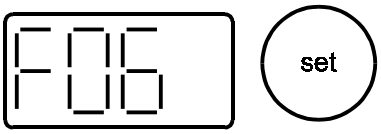


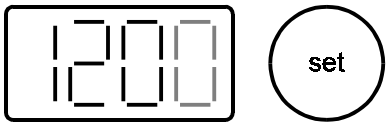
9.1.9 Current transformer ratio

CR 2000:



CR 2000B:



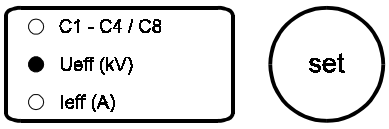


The programming of the current transformer ratio is not necesary for the operation of the CONDENSOMATIC. If it is set correctly, then all values are displayed as primary values.
This setting can be changed by choosing the menu item „I_{eff}“ and pressing **set** to activate the programming mode.
The ratio of primary to secondary value, that is given on your current transformer, has to be set, e.g. 500/5 = 100 or 1200/1 = 1200.

The value is set character after character, each character has to be confirmed with **set**. The confirmation of the last character stores the value.

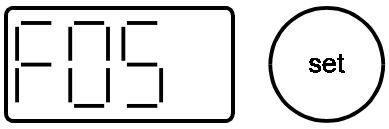
9.1.10 Voltage transformer ratio

CR 2000:



This value must only be set in installations with measurement on the medium voltage level. The programming is similar to the programming of the current transformer ratio.

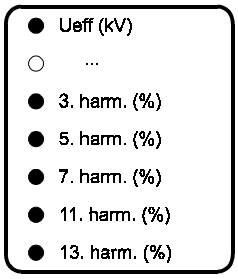
CR 2000B:



9.1.11 Displaying of harmonics, limit for harmonics

The CONDENSOMATIC (not CR 2000B) shows, separated for voltage and current, the harmonic levelfor the 3., 5., 7., 11. and 13. harmonic as percentage of the fundamental wave.
The combination of the LEDs „U_{eff}“ bzw. „I_{eff}“ together with the LED for the harmonic shows the chosen harmonic value. Is the total harmonic level of the voltage is chosen, then all LEDs for the harmonics light.
In all types of regulators additionally the total harmonic distortion of the voltage is available (see examples of display contents).

CR 2000:

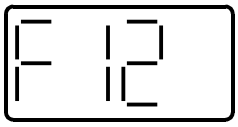


For the indication of the harmonic distortion of the voltage all LEDs for harmonics and voltage ligh (CR 2000B: display of „F12“).

Using **set** one activates the programming mode for the limit for the harmonic load. If the total harmonic load exceeds this limit, which is programmable between 3% and 10%, for more than 15 minutes, then all outputs are switched off.
The following settings are recommended, depending on the kind of reactive power compensation equipment:

non-reactor protected capacitor banks:	3%
5.67% and 7% reactor protection:	6%
14% reactor protection:	8%

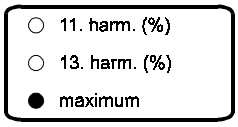
CR 2000B:

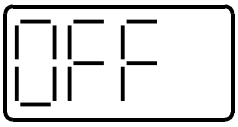


If your supplier of the reactive power compensation equipment makes other recommendations, these have to be considered.

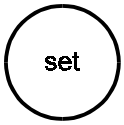
9.2 Maximum menu (only CR 2000)

CR 2000:

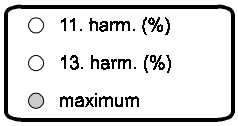


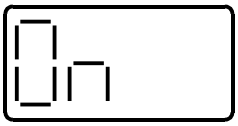


From the main menu one gets to the maximum menu as follows:



Choose the menu item„maximum“, using the arrow keys. The LED „maximum“ lights and the display shows „OFF“. By pressing the **set** key, the maximum menu is activated, the display alters to „On“ and the LED „maximum“ flashes. The next preesing of **set** deactivates the maximum menu and the display changes to „OFF“.



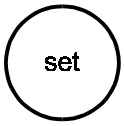


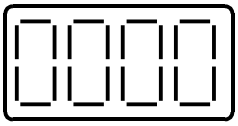
When the maximum menu is active, the menu items for powers and harmonics are available similar to the main menu. The menu items for cos j - settings and the step display are not available. The flashing LED „maximum“ indicates, that the actually displayed value is a stored maximum value.
The return to the main menu is done via the menu item „maximum“, choosing „OFF“.

CR 2000B:

For type CR 2000B only the maximum values of voltage and harmonic distortion are available in the setup menu (see setup menu).

9.3 Reset of maximum values



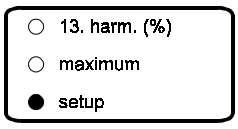


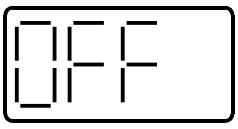
Any stored maximum can be deleted using the **set** key. The value is set to zero and stored again after the next measurement. The maximum values of voltage, current and the powers are deleted automatically, if the transformer ratio for voltage or current is changed. A reset of the regulator includes the deletion of all maximum values.

9.4 Setup menu

In the setup menu several settings allow the adaption of the control characteristic of the CONDENSOMATIC to special requirements. Additionally the number of switchings and the operationg hours for every output can be displayed.

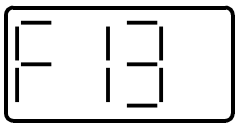
CR 2000:

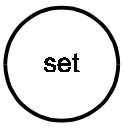


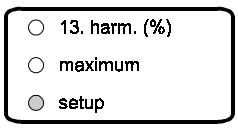


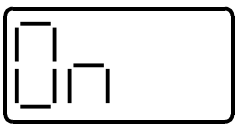
Choose the menu item „setup“ in the main menu, using the arrow keys. The LED „setup“ lights (CR 2000B: display „F12“) and the display showst „OFF“. Press the **set** key to avtivate the setup menu, the dispaly changes to „On“ and the LED „setup“ starts to flash. Pressing **set** again returns to the main menu.

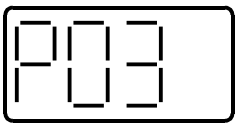
CR 2000B:





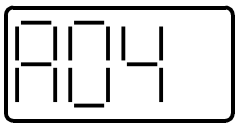






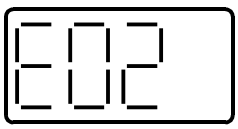
Inside the setup menu the item list on the left is not available. If another menu item is chosen with the arrow keys, than first the number of the new menu item is displayed for approximately 3 seconds, e.g. P03. After this the corresponding value is displayed continuously. For menu items with programming function, the programming mode is activated with the **set** key. After changing the value it is stored with **set**. The return to the main menu is done via the menu item „setup“ (CR 2000: LED „setup“ lights continuously instead of flashing) and the setting „OFF“.

9.4.1 Number of switchings



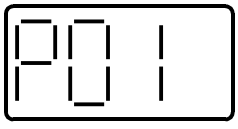
For the displaying of the number of switchings the menu item „A01“ bis „A08“ , corresponding to the outputs 1 - 8) is chosen (e.g. output 4). After 3 seconds the number of switchings for this output is displayed (display x 100). Pressing **set** resets this value to zero (e.g. after replacing the contactors).

9.4.2 Operating hours



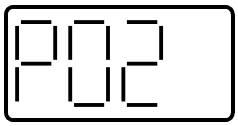
Using the arrow keys one of the menu items „E01“ bis „E08“ is chosen in the setup menu. After 3 seconds the total operating hours of this output are displayed (display x 100). The value can be reset to zero with the **set** key (e.g. after replacing the capacitors).

9.4.3 Mains frequency



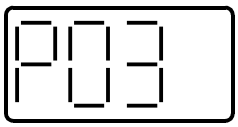
The actual mains frequency is displayed under the menu item „P01“.

9.4.4 Switching time



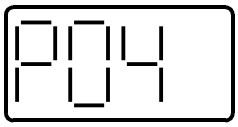
The menu item „P02“ shows the programmed switching time.
A reactive load , which is approximately twice the capacitor power connected to the first output, results in a switcing activity after this time. For smaller reactive loads this time is delayed up to ten times to avoid unnecessary switchings.
By pressing **set** the programming mode is activated and the switcing time can be programmed from 3 - 30 seconds.
The factory setting 15 seconds is optimal for the most applications, great reactive loads are compensated quick enough, small reactive loads do not result in unnecessary switchings.

9.4.5 Alarm time



If the alarm-cos j cannot be reached for longer than the programmed alarm time, then an alarm is displayed and the external alarm output contact is closed. After pressing **set** this setting can be changed from 30 up to 300 minutes.The factory setting is 60 minutes.
This alarm time does not delay any other alarm (e.g. harmonics alarm).

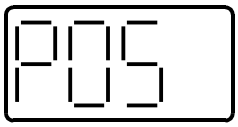
9.4.6 Alarm confirmation



This setting affects the behaviour of alarm messages in the display.
If it this set to „OFF“, then the alarm messages in the display disappear with their causes (e.g. return of the measuring voltage). The setting „On“ has the effect, that alarm messages do not disappear automatically. They have to be confirmed with the **set** key.

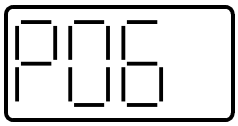
9.4.7 Fixed compensation power

Caution! This setting must not be changed before the cureent and voltage transformer ratios are set correctly. Otherwise the regulator switches on too much capacitor power.



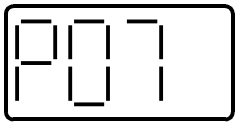
In most installations the mesauring for the compensation is done behind the power transformer, that means, that the transformers reactive power is not measured and therefore not compensated. In lots of cases the energy supplier measures before the power transformer and the reactive power has to be paid. In the past this reactive power has been compensated basically with a fixed capacitor.
By programming a fixed compensation power as a basic load, the reactive power of the transformer can be compensated by the automatic reactive power compensation equipment.
According to the actual load the CONDENSOMATIC calculates the required capacitor power and adds the fixed compensation power. The result is switched on with the switching outputs.
This has the effect, that the actual cos j is always better than the target - cos j, at the measuring point of the compensation equipmentit can get capacitive.

9.4.8 Limit for switchings



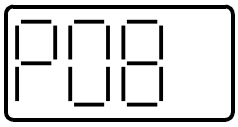
The CONDENSOMATIC counts the cnumber of switchings for every output. With the programming of a surveilled limit, contactors can be replaced at the right time. If the number of switchings of any output exceeds this limit (factory setting 100.000), this is displayed with „AL.A1“ - „AL.A8“.
The setting „0“ disables this function.
The message in the display must be confirmed with **set**. A new message for an output, that has exceeded the limit once before, can only be generated, if the number of switchingsfor this output has been reset to zero before.

9.4.9 Over- and undervoltage



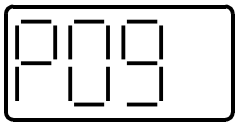
The programmation of the rated measuring voltage enables over- and undervolatge detection.
If the actual measuring voltage diverges from the set value more than 15%, then all outputs are switched off to avoid damage and overload of contactors and capacitors.
The range is from 58 to 700 V, the setting „OFF“ (<58 Volt) disables this function (factory setting).

9.4.10 Device number (only CR 2000 with option S)



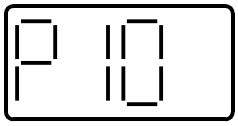
The device number indentifies the CONDENSOMATIC 2000 on a RS485- line with up to 32 instruments. The range is from 1 to 32.

9.4.11 Baudrate (only CR 2000 with option S)



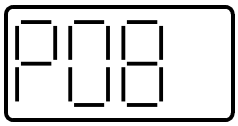
The baudrate is the operating speed of the RS485-line. The baudrate must be set equal for master and slaves on the bus. The CONDENSOMATIC can operate at a baudrate of 300, 600, 1200, 2400, 4800 or 9600 baud.

9.4.12 Parity (only CR 2000 with option S)



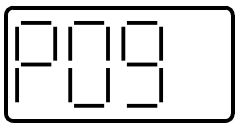
The parity setting has to be equal for all connected instruments on the line. The settings 0, 1, 2 mean:
0=no parity, 1=odd, 2=even.

9.4.13 Maximum voltage (only CR 2000B)



The CONDENSOMATIC 2000B shows the maximum measured voltage under this menu item. Using **set** resets the maximum value.

9.4.14 Maximum harmonic distortion (only CR 2000B)



Here the maximum distortion of the voltage is displayed. Pressing **set** resets this maximum value.

10. Alarms in automatic mode

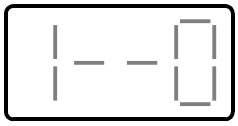
Alarm conditions are indicated with a flashing display message and sometimes additionally through flashing LEDs in the menu list. If more than one alarm is pending, these are repeated one after the other till their causes disappear and, depending on the settings, they have been confirmed with **set**.
All alarms, excluding the exceeding of the limit for switchings, include the closing of the external alarm contact (optional for CR 2000B) as long as the alarm is pending.
The alarms for missing measuring signals, for defective outputs and for harmonic overload result in a temporary or continuous switching off of outputs.

10.1 Cos j-alarm

This alarm appears if the active alarm-cos j cannot be reached for longer than the programmed alarm time by switching on and off all suitable outputs.

Check the setting for alarm-cos j and correct it , if required. If the setting is correct, then the installed capacitor power has to be adapted by repairment or extension (see also the maximum of missing capacitor power)

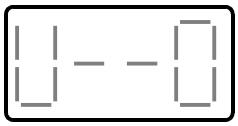
10.2 Missing measuring current alarm



If the measuring current is lower than 20 mA, all capacitor steps are switched off.

This alarm must be ignored, if no load is present. Othwerwise the measuring current circuit muist be checked, present current transformer bridges have to be closed. The automatic control is continued, if the measuring signals exececds 20 mA.

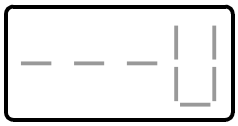
10.3 Undervoltage, missing measuring voltage alarm



This alarm can have one of the two following causes. If the rated measuring voltage is programmed, alarm is given and all capacitor steps are switched off, if the measuring voltage is lower than 85% of the rated value. Incase the rated value is not programmed, alarm is given for measuring voltages lower than 50 V.

To avoid unnecessary alarms, the rated measuring voltage has to be set correctly. A lower value can be programmed, if the supplier of the contactors guarantees correct function of the contactors even at lower voltages.

10.4 Overvoltage alarm



Alarm for overvoltage is only possible, if the rated measuring voltage has been programmed. If the measuring voltage exceeds the programmed value for more than 15%, all outputs are switched off to avoid overload, and alarm is displayed.

If this alarm appears frequently, because of the voltage being permanently high, one should check, if the capactitors are suitable for higher voltages. If they are, the programmed value for the rated measuring voltage can be increased.

10.5 Resonance alarm

If the harmonic load reaches very high values due to a resonancs, all outputs are switched off immediately. After the end of the resonance automatic control is continued.

The situation in the supply system has to be clearified. Perhaps non-reactor protected reactive power compensation equipments have to be substituted with reactor protected equipments.

10.6 Harmonic overload

If the total harmonic load, calculated from the displayed harmonic values, exceeds the programmed limit for more than 15 minutes, al capacitors are switched off and alarm is displayed. The delay time is shortened for higher harmonic overloads. Automatic control is continued, if the harmonic load has reached values lower than the limit.

Check the programmed limit against the table in chapter „Harmonics limit“.

10.7 Defective outputs

If the capacitor power related to an output is detected to be lower than 80% of the power determined during calibration, the respective output is switched off an displayed with its number (e.g.: output 2). It is not used any more.

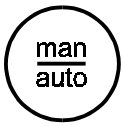
The output can be switched on manually to check its power. After repairing the capacitors a new calibration must be started by resetting the regulator.

10.8 Operating hours limit

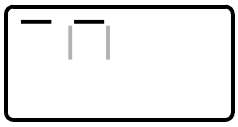
The output with the displayed number (e.g.: output 7) has exceeded the limit programmed in the setup menu.
This message has to confirmed with **set**. Resetting the number of operating hours for this output makes the feature available again. Automatic control is not affected and the external alarm contact is not closed.

11. Manual mode

The manual operating mode is used for stopping the automatic control, for determination of fault causes by switching on and off outputs manually and for switching off of all outputs before disconnecting the operating voltage.



At any time and ion any menu pressing the **man** key starts the manual mode. This is indicated with the LED „man“ .
When changed, the operating mode ist stored, so that a regulator switched off in manual mode will start again in manual mode.
Short pressing of **man** starts the manual mode with all switched on outputs remainning switched on, only the automatic control and the alarm functions are disabled. Holding the key for approximately 3 secondes starts the immediate switching off of all outputs. Automatic control is disabled. The storage of the operating mode guarantees, that all outsputs are kept switched off permanently without need for external switches.



In the manual mode the step display is active, extended by two flashing segments, which form a cursor. This cursor marks the actually chosen output, which can be switched on and off with the **set** key. Switching off blocks an output for 30 seconds. A new swichting on is delayed till the end of this blocking time, indicated by a flashing LED „C+“ (not CR 2000B).

In the manual mode alarms are not active. Avoid capacitive overload.

When changing fromthe manual mode to automatic mode, a blocking time of 30 seconds ia active for the automatic control. This way, the power of previously switched on outputs can be checked.

12. RS485 interface (only CR 2000 with option S)

12.1 Technical data

interface standard:	RS485
max. no. of instrumentsr:	32
baudrates:	300, 600, 1200, 2400, 4800, 9600 baud
parity:	no parity, odd, even
data bits:	8
stop bits:	1
max. line length:	1200 m with screened and terminated wire
protocol:	special protocol, see below
operating voltage:	230V / 50-60Hz
power consumption:	max. 2VA

12.2 Settings for RS485 interface

The numbers of data- and stopbits are fixed to 8 data bits and 1 stop bit.

The behaviour of the interface is programmed through the parameters „device no.“, „baudrate“ and „parity“.

12.3 Request for settings and data

The requestable parameters and measured data, further on called „variables“, have numbers from 0 to 23 and from 32 to 83. All the variables can be requested from the regulator by these numbers.

To read a variable, a sequence of characters is send to the regulator, starting with <STX> (= 02 dec), followed by the device no. of the regulator (1 - 32), the read command „R“ (= 82 dec), the no. of the variable, two dummy characters, a ending character <ETX> (=03 dec) and a checksum byte (=exclusive or of all preceeding characters).

syntax: <STX>, device no., R, no. of variable, dummy, dummy, <ETX>, checksum

example: 02 01 82 01 00 00 03 83

The example explaines the reading of the target-cos j for tariff 2 (variable no. 01) from the regulator with the device no. 1.

The regulator answers the request, if a reading command is determined to be complete and correct.
The answering sequence consists of the start character <STX>, the device no. of the regulator, the answer command „A“ (= 65 dec),the variable no., two bytes data, the ending character <ETX> and the checksum.

12.4 Programming of parameters

For the programming of parameters one has to consider the limits for each parameter, which are listed in the enclosed table. The regulator does not check the programmed data to be within the allowed limits. Wrong parameter settings will affect correct function of the regulator or its reliability.

The programming sequence consists of the start character <STX>, the device no. of the regulator, the write command „W“ (= 87 dec), the variable no., two bytes data to be programmed, the ending character<ETX> and the checksum.

For the reset of maximum values of powers and harmonics the content of the data bytes is not relevant. Any write command to the variables results in a reset of these values.

12.5 List of variable numbers (with limits)

In Appendix 1 of this operating manual the variables and their value-ranges are listet.

13. Technical data

measuring system:	single phase, electronic
measuring voltage:	58 - 690 V
operating voltage:	230 V *
frequency:	50 - 60 Hz
measuring current:	1 A or 5 A
relay load:	max. 250 V / 4 A
ambient temperature:	-10 - +55°C
case:	safety insulation for mounting in switchboard panels or on DIN-rail
dimensions:	144 x 144 x 55 mm
protection class:	front IP42 (IP54 on request) rear side IP20
connection:	pluggable connection block

* other voltages on request

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