Operating instructions

RATIO compressor control for screw compressors

Before installing or starting the compressor for the first time, this manual should be studied carefully to obtain a clear knowledge of the unit and of the duties to be performed while operating and maintaining the unit.

RETAIN THIS MANUAL WITH UNIT. This technical manual contains IMPORTANT SAFETY DATA and should be kept with the air compressor at all times.

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BOGE

Operating instructions
RATIO compressor control
for screw compressors

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Part 1:
RATIO

These operating instructions contain a description of the RATIO control system.

General

BOGE compressors are equipped with a modern control.
RATIO, an integrated control and monitoring concept, with two objectives:

– Energy savings and thus reduction of ongoing costs.
– Prolonging the service life of the compressor due to minimum wear.

All programmed data is stored in a memory module (EEPROM).
Thus the stored information is even available following a power failure.

Microcontroller

The BOGE-RATIO control adapts dynamically to the respective operating conditions. A micro-controller assumes the following three tasks:

1. **Automatic selection of the most economical operating mode**
   The micro-controller calculates the optimum operating mode from the current operating state and a programmed ideal value, also taking into account the constant compressor system data (e.g. delivery quantity, receiver volume, motor switching cycles) as well as the current variables (e.g. compressed air consumption, supply and non-supply times, pressure increase and decrease speed).
   In order to save operating costs, it always strives for the most economical intermittent operation.
2. **Automatic optimization of the motor switching cycles**
   The micro-controller calculates the optimum number of motor switching cycles. This protects the drive motor and prolongs the service life of the plant.
3. **Automatic reminder of the maintenance intervals**
   The microcontroller monitors the maintenance intervals.

Operating and control panel

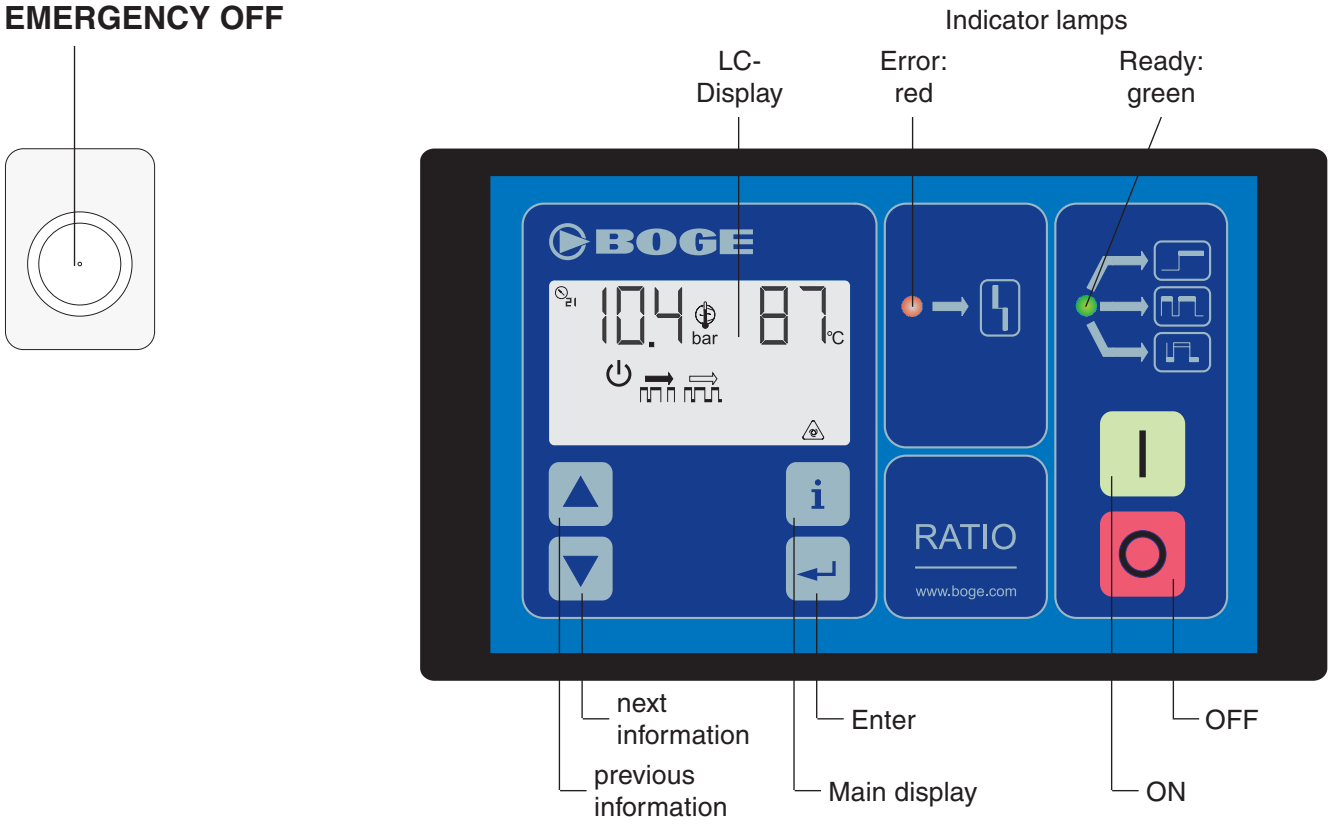
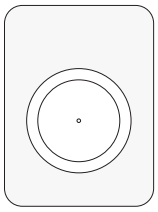
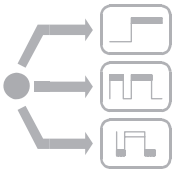


Fig. 1.1: RATIO operating panel

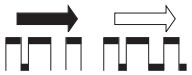
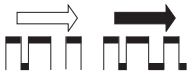
Operating elements RATIO

Operating/control element	Function	Operation/Explanation
EMERGENCY OFF switch 	To switch off the compressor in an emergency	– Press the EMERGENCY OFF switch. The switch engages and interrupts the control voltage. All displays are cut off from the power. After rectifying the fault, unlock the EMERGENCY OFF switch: – Turn the EMERGENCY OFF switch a quarter turn clockwise. – Quit the display test by pressing OFF key ○. – The compressor is ready to use.  **Important!** Always switch the compressor off with the OFF key. Only use EMERGENCY OFF in an emergency!
ON key 	To switch the compressor on	– Press the ON key: The operating status depends on the network pressure: 1. Network pressure greater than lower cut-in pressure. Compressor remains ready. 2. Network pressure lower than lower cut-in pressure. Compressor starts.
OFF key 	To switch the compressor off	If necessary, continues to run in idle until decrease in system pressure.
[Up] key 	Display selection in LC-Display	The ▲ key has two functions: 1. It shows the previous information, one step **backward**. 2. It normally increases the parameter value.
[Down] key 	Display selection in LC-Display	The ▼ key has two functions: 1. It shows the next information one step **forwards**. 2. It normally reduces the parameter value.
INFO key 	Select desired main information	– Press the INFO key. The display shows the main information or fault/warning message.
ENTER key 	For confirmation in parameterization and acknowledgement of messages	– See parameterization section.

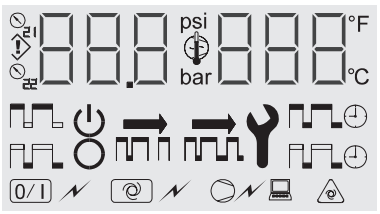
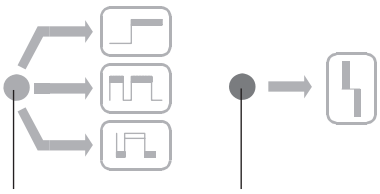
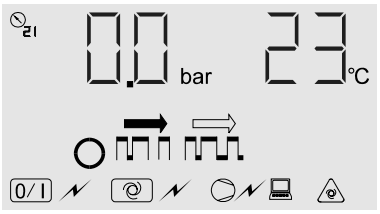
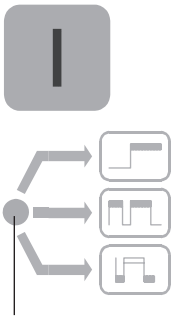
Operating elements RATIO

Operating/control element	Function	Operation/Explanation
Lamp = green 	Ready	The green indicator lamp indicates that the machine is ready.
Lamp = red 	Fault	The red indicator lamp indicates a fault.
	Network pressure display	Pressure gauge or target value (network).
	System pressure display	Pressure gauge system pressure (compressor).
	Parameterization	If parameterization has been started, this symbol appears in the top left of the display.
3-digit 7-segment display P:  bar	Displays: Pressure	Shown in bar with a decimal point between the second and third digit.
3-digit 7-segment display T:  °C	Displays: Temperature	In °C.
 Thermometer		Compressed air parameterization start undergoing parameterization or frost run = blinks.

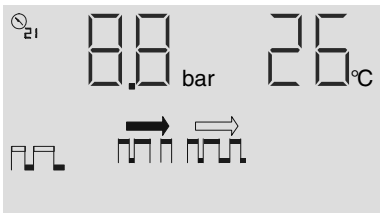
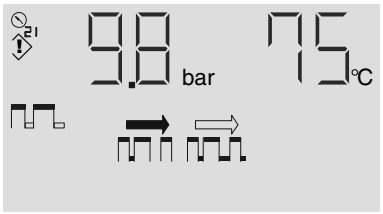
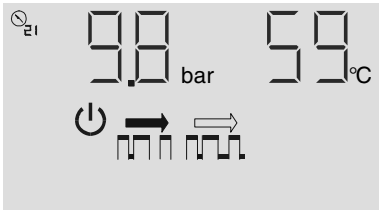
Operating elements RATIO

Operating/control element	Function	Operation/Explanation
	OFF or motor or receiver	The circle stands for three functions: 1. The compressor is switched off. 2. For motor servicing period. 3. Servicing symbol (receiver inspection) (replace wearing parts).
	Stand by	Automatic standby.
	Idle	(Automatic) idling phase.
	Load or load speed	Output phase or output cycle.
	Automatic operating mode selection	Automatic mode **with** standby phases enabled.
	Continuous operation	Automatic mode **without** standby phases enabled.
	Total running time	Total motor operating hours.
	Idle operation	Idle operating hours.
	Servicing due	Information on current or impending servicing.
	**Auto-Restart** (automatic restart enabled after network failure)	Energy-independent ON-OFF save function set.
	External output enable	Remote output enable (e.g., from master control).
	Remote On-Off Mode	Remote ON-OFF (e.g., from control panel).
	Online-Mode	Serial interface activated.

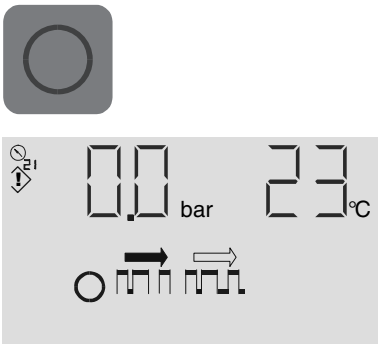
Operation RATIO

Operating/control element	Function	Operation/Explanation
  green red	Function control of display elements	– After unlocking the **EMERGENCY OFF switch** and turning on the **supply voltage**, all enablable display elements of the control appear at the same time – including the two indicator lamps. – If standby was not saved (no Auto-Restart), this status must first be ended by pressing the OFF switch **O**, before the compressor can be switched on. – Otherwise it disappears automatically after a set time and the compressor is on standby again without touching the controls – see also Power failure cycle protection.
	Main display RATIO	– This display either appears after completion of the network failure phase (as described under display element function control) or by pressing the **i** key or by scrolling via ↓ or ↑-keys: – The network pressure is shown at the top left (pressure gauge 21), and at the top right the (final compression) **temperature,** in the centre are the two operating mode curves: the left arrow shaded (as shown here) = automatic mode selection, right = continuous operation, the circle left of this means: off here. The symbol at the bottom left is for *setting Remote-On-Off and next to it the symbol for external output enable,* next to the right the symbol *online* and at the extreme right at the bottom the symbol for *cut-in-save* (Auto-Re-start). These four symbols only appear when the respective setting has been made.
 green	Switch on the compressor	If no fault is reported, pressing I will switch on the green indicator lamp (compressor on standby) which means: the pressure control function is activated – see also Remote On-Off.

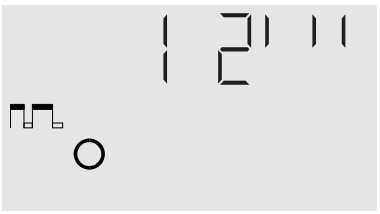
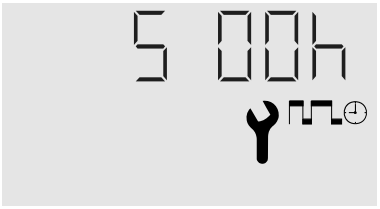
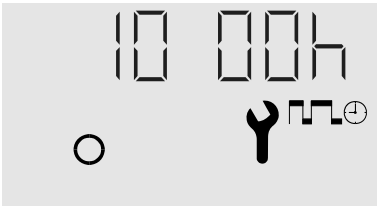
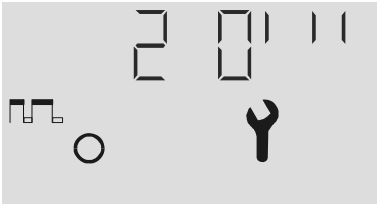
Operation RATIO

Operating/control element	Function	Operation/Explanation
	Run-up phase	If required the pressure control starts the motor – if the motor spinning time is finished, the system pressure has decreased and no motor switching limitation is necessary (otherwise the idling symbol ⏻ - blinks → the idling symbol appears during the time-controlled run-up or star phase. For a star/ delta contactor combination the following applies: the star contactor is switched on first followed by the network contactor 20 ms later. The idling symbol signals the state of the electropneumatic control. Thus it also appears after reaching the set maximum pressure – during the decrease phase of the system pressure.
	Load operation	The run-up phase – or star phase – is automatically finished by switching the electropneumatical control into load operation and the symbol ⊓⊓ appears in the display – probably first a change to delta connection takes place 60 ms after the star phase. Once the set maximum pressure is reached, the idling symbol ⊓⊓ appears. The system pressure is reduced automatically.
	Stand by (Ready for operation)	If the network pressure (in idling mode) drops below the max. start-up back pressure and the automatic operating cycles monitoring allows it, the control unit switches the motor off and the Stand by symbol ⏻ is shown in the display. If the network pressure drops to the set minimum pressure within the idling phase, the compressor switches back to load operation and the respective symbol is displayed again. If this happens shortly after having switched to stand still, it has to be waited in case of contactor connection – cf. also motor spinning time – until the compressors is switched off for 20 s, to be sure that the motor stands completely still, before you may start it again. If the pressure is below the switch-on pressure this is signalled by the blinking of the Stand-by symbol until the compressor starts again.

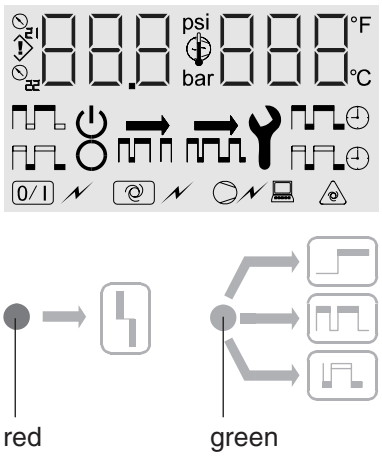
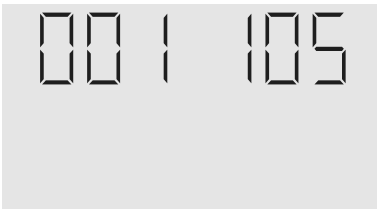
Operation RATIO

Operating/control element	Function	Operation/Explanation
	Switch off the compressor	Press ***O*** → Compressor Off → and the pressure control function is deactivated and the display shows the *idling symbol.* During this time the green indicator blinks. The symbol ***O*** then appears and the green indicator lamp is extinguished.
 red	Fault messages	If the control unit detects a fault, the compressor is switched off immediately and automatically – without an idling phase –, the *fault* **relay** drops and a digit on the right of the current pressure blinks together with the red indicator lamp. The blinking digit indicates the detected fault (see also message key table page 1.12).
	Operating times, output cycles, maintenance deadlines, display test and Software-No.	
	Compressor system pressure	Press ↓**-key** → and the segment display shows the compressor system pressure (pressure gauge 22).
 means: 124h total running time	Total operating time	Press ↓**-key** a second time → and the segment display shows the total operating time in hours together with the total running time symbol: .

Operation RATIO

Operating/control element	Function	Operation/Explanation
 means: 2hrs idling time	Idling time	Press ↓**-key** a third time → and the display shows the Idling time counter in h (hours) and the Idling symbol: ⎍⏲.
 means: 12 x 10^3 = 12000 output cycles	Output-cycle-counter	Press ↓**-key** a fourth time → and the display shows the 1000-output-cycles counter with the exponent 10^3 (x 1000), the load cycle symbol and the circle (here: receiver).
 means: 500hrs until the next compressor servicing	Compressor servicing	Press ↓**-key** a fifth time → and the display shows the operating time (in hours) until the compressor servicing and the Running time and Servicing symbols (spanner).
 means: 1000hrs until the next motor servicing	Motor servicing	Press ↓**-key** a sixth time → and the display shows the operating time until the next Motor servicing and the symbols **O** (here for motor), running time and servicing (spanner).
 means: 20 x 10^3 = 20000 Load cycles until the next receiver servicing or change of wearing parts	Next receiver servicing/change of wearing parts depending on output cycles	Press ↓**-key** a seventh time → and the display shows the 1000-output cycle servicing counter with the exponent 10^3 (x 1000), the Load-cycle symbol, the circle (here for receiver) and the servicing symbol (spanner), meaning the number of possible output cycles until the next receiver inspection or change of wearing parts.

Operation RATIO

Operating/control element	Function	Operation/Explanation
 means: $P_{Max.}$ = 10,0 bar (cut out pressure)	Upper target pressure (network pressure)	Press ↓**-key** an eighth time → and the segment display shows the Upper target pressure and a dash at the top right next to it.
 means: $P_{Min.}$ = 9,0 bar (cut in pressure)	Lower target pressure (network pressure)	Press ↓**-key** a ninth time → and the segment display shows the Lower target pressure and a dash at the bottom right next to it.
	Display element test	Press ↓**-key** a tenth time → and the display shows all symbols and segments together with the two indicator lamps.
 means Software-No. 1105	Software-No.	Press ↓**-key** an eleventh time → and the segment display area shows the Software-No.
	Software-Version No.	**Meaning**
	0xx xxx	Screw compressor, all sizes
	1xx xxx	Screw compressor up to 22 kW with frequency converter
	2xx xxx	Screw compressor bigger than 22 kW with frequency converter
	3xx xxx	Piston compressor

Operation RATIO

Operating/control element	Function	Operation/Explanation
		Press ↓**-key** a twelfth time → to return to the **main display.** Press ↑**-key** - to watch the displays in the reversed direction. If no key is pressed for **five minutes**, the main display automatically reappears.

Parameterization of frequency converter without running motor

Normally the converter is under tension as soon as the **I-**key (On) is pressed and the compressor motor starts. In case the frequency converter has to be parameterized during motor stand-still – you only have to press the ↵**-key** – when the main display is shown – and the compressor is switched off.
Then the converter supply contactor starts up and the motor remains in stand-still – the green LED is not illuminated.
By pressing the **O**-key (Off) the converter supply contactor drops out.

Error key table

Each message is automatically **registered** by the control, together with the associated time, thus putting an overview at the disposal of BOGE-Service.

Error No.	Meaning	Compr.-cut-out
0	Compr. air treatment (dryer or condensate drain gives error message)	[1])
1	Final compression temperature > 110°C, 230°F	X
2	Motor temperature too high	X
3	Excessive current of vent. motor	X
4	Incorrect direction of rotation	X
5	Excessive compressor system pressure	X
6	Excessive diff. pressure of intake filter	
7	Excessive diff. pressure of oil filter	
8	Excessive diff. pressure of oil separator	
9	No output	X
10	Motor servicing due	
11	Compressor servicing due	
12	System pressure decrease too slow	
13	Frequency converter gives error message	X
14	Temperature too low	X
15	Suction control faulty (suction control or solenoid valve, if necessary clean proportional controller)	
16	Network pressure transmitter faulty	X
17	System pressure increases too quickly (lack of oil, oil too old or even with monitoring of the rotational direction a false rotational direction cannot be excluded)	X
18	Master control tries to go below P_{min} – cf parameterization "External output enable"	
19	Previous net switch-on phase was too short (possible reasons: coil short-circuit 'solenoid valve', 'delta contactor' or 'ventilator contactor') → automatically increased delay time in corr. with permissible number of motor switch cycles	
20	Master control tires to exceed P_{max} – cf parameterization "External output enable"	
21	Receiver or wearing parts inspection due	
22	Not assigned here	
23	Not assigned here	
24	Not assigned here	
25	Control unit Reconciliation error	X
26	Control unit **O**-key does not open	X
27	Control unit **I**-key does not open	X
28	Control unit **i**-key does not open	
29	Control unit ↵-key does not open	
30	Control unit "arrow up" does not open	
31	Control unit "arrow down" does not open	
32	Network pressure-transmitter wire breakage	X
33	Compr.system pressure-transmitter wire breakage	X
34	Compr.system pressure-transmitter faulty	X
35	Excessive diff. pressure return valve	
36	Bus Life-Bit did not toggle	
38	Current of compressor motor is too high	X

[1]) adjustable

General

The control unit calculates from the current operating data the respective best operating mode and automatically selects it.
The parameters are adjustable.
In order to prevent unintentional changes to pre-set parameters, these parameters are codeword-protected.

ATTENTION!
Never change the value of a parameter if you do not know what it means!
This may cause incorrect behaviour of the control unit!
Do not experiment with parameter settings!
Always call BOGE-Service if you are unsure or have any doubts.

Parameterization

In general the following is applicable: If a parameterization, as described below, is started at the top right in the display the symbol ⚠ appears and the set value or status blinks.

Enter Parameterization Code

1. Display Software-No. (see Software No.).
2. **Press ENTER** ↵ → and the parameterization symbol ⚠ is shown on the left, followed by three zeros, the left of which blinks.
3. **Press** ↑ or ↓ to change the first digit.
4. **Press** ↵ → and now the middle zero blinks.
5. **Press** ↑ or ↓ to change the second digit.
6. **Press** ↵ → and now the right zero blinks.
7. **Press** ↑ or ↓ to change the third digit.
8. **Press** ↵ → the display will now branch off depending on the set number – if the value is invalid the main display will reappear.

Each parameterization is automatically **registered** by the control, together with the associated time, thus putting an overview at the disposal of BOGE-Service.

Set the compressor servicing interval and restart

The servicing interval memory can be set to a value between 300 and 9900 hours in one hundred hours increments as long as the interval time limit is monitored by the control – if it is not used it has to be set to 10000 h, as it stops the down counter.

1. Enter **Code 111** as described under coded parameterization → and the display shows the compressor servicing interval in blinking digits (Compressor servicing).
2. **Press** the ↑ or ↓-key to change the value in big steps.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.

Set the motor servicing interval and restart

The motor servicing interval memory can be set to a value between 500 and 29900 hours in one hundred hours increments as long as the motor interval time limit is monitored by the control – if it is not used it has to be set to 30000 h, as it stops the down counter.

1. Enter **Code 222** as described under coded parameterization → and the display shows the compressor servicing interval in blinking digits (Motor servicing).
2. **Press** the ↑ or ↓-key to change the value in big steps.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.

Set load cycles dependent servicing / inspection and restart

The output cycles servicing interval memory can be set to a value between 100,000 and 1,900,000 cycles in increments of onehundredthousand, as long as the output cycles servicing interval is monitored by the control – if it is not used it has to be set to 2,000,000 cycles as it stops the down counter.

1. Enter **Code 333** as described under coded parameterization → and the display shows the receiver inspection interval in blinking digits (receiver inspection/change of wearing parts).
2. **Press** the ↑ or ↓ keys to change the value in big steps.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.

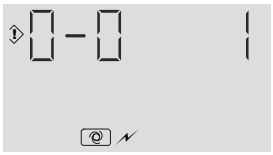
Change target pressure values (P_{max} and P_{min})

If changes are made to these target values, the value of P_{min} is automatically held or brought outside any applicable minimum hysteresis range.

1. Enter **Code 360** as described under coded parameterization → and the display shows the upper target pressure value, but blinking.
2. **Press** ↑ or ↓-key to change the value.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the lower target pressure value apears (blinking).
4. This value can now be changed by pressing the ↑ or ↓-key.
5. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.
6. It is not permissible to set the bottom pressure target value below the stipulated p_{min} value. In case this should be necessary please contact BOGE-Service beforehand.

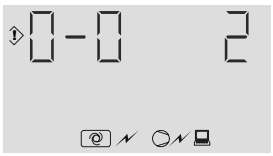
External output enable


①


②


③


④


⑤


⑥

If the output of a compressor is to be enabled by a higher level control unit, its parameterization must be changed as follows:

1. Enter **Code 210** as described under parameterization → and the display shows from Fig. ① on the left. The 'zero' at the top right blinks. This display means: no additional enabling device is programmed.
2. Press ↓**-key** to switch to Fig. ② – ↑**-key** to switch back. Digit One and the bottom symbol 'external output release' are blinking.
   This display means: enabling device (e.g., MCS) is enabled via input **'Pressure control'** (for potential-free contact) – see also 'Switching *Local/Remote* via key switch' and 'RS485-Bus-address setting'. If the ↵-key is pressed during this, one of the following pictures appears ③ + ④ –:

   Fig. 3: The three top dashes and the 1 are blinking. The P and the three top dashes mean, that falling below the network pressure (Manometer 21) P_{min} starts a load operation, even with an open input **'Pressure control'** – number '18' is displayed and the "warning" relay is activated – thus actuating the operating mode. Press ↓**-key** to switch to Fig. ④ – press ↑ to toggle back –:

   Fig. 4: The falling and rising (dotted) pressure curve and digit 0 are blinking. This figures means that due to the open input **'Pressure control'** a falling below the network pressure P_{min} is possible (as e.g. at night and over the weekend).

   Press ↵**-key** to overwrite the non-volatile EEPROM as per the blinking symbol, and the main display reappears.

   In the bottom display the symbol appears. The following applies even with external enabling: If the upper target pressure value in the compressor **is exceeded**, the output will be **shut off.** Only when the the pressure drops to the lower target pressure value the external control resumes.

   If the ↵-key under point 2 was not pressed, press ↓-key to change to Fig. ⑤ – press ↑ to toggle back –:

   Digit Two and the two bottom symbols 'external output release' and 'online' are blinking. This display means: enabling device (e.g., master control) is enabled via a serial interface, if the input 'external output release' is closed – see also 'Switching *Local/Remote* via key switch' and 'RS485-Bus-address setting'.
3. Press ↓**-key**, if convenient (not with key switch function) to switch to Fig. ⑥ – press ↑ to toggle back.

   Manometer '22' and digit 3 are blinking. This setting means that a limiting suction pressure switch (continuous output control) is connected to the input **'Pressure control'**.
4. Press ↵**-key** to overwrite the non-volatile EEPROM as per the blinking symbol, and the main display reappears. If the compressor is set for an output enabling device (e.g. mode 2), the bottom of the main display shows the appropriate Symbol . The following applies even with external enabling: If the upper target pressure value in the compressor **is exceeded**, the output will be **shut off.** Only when the the pressure drops to the lower target pressure value the external control resumes.

Proportional control
(not in the case of frequency regulated compressors)

The limiting suction pressure switch (min. output) of a proportional control is – in case of a **single compressor** (without higher-level pressure control) – connected to the input *external output enable* – cf point 3 (external output enable).
If the proportional control is used **in connection with a suitable higher-level control**, the limiting suction pressure switch is connected directly to the higher-level control and this control subsequently to the input *external output enable,* which then has to be parameterized correspondingly – cf point 2 and 3 (external output enable).

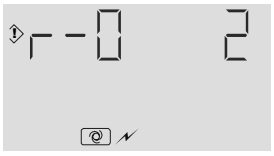
Timer

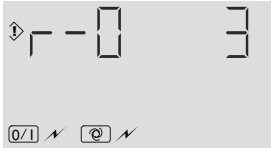
A timer can either be connected individually or in combination with a proportional control or a higher-level control. The parameterization has to be done according to the following table:

Timer at input 'external output enable' alias **'Pressure control'** – ...	External output enable	
	Parameteriz. no.	Sub-parameteriz. no.
single	1	0
series connection with higher-level control	1	0
and pressure control via RS485 (as e.g. Profibus DP)	2	not available
series connection with limiting suction pressure switch for proportional control	3	not available

Switching *Local-Remote* via key switch

①


②



③

If a key switch is switched to 'Remote' for the first time or if **Code 770** was entered after the control unit was able to register a key switch, one of the figures on the left appears.

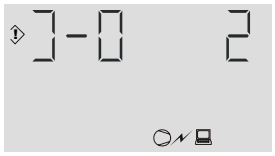
1. Number One and the symbol 'Remote On-Off' are blinking. Fig. ① means, that the key switch exclusively refers to the selection of switching sources for the readiness for operation of the compressor (green LED). If this setting is selected, the parameterization 'Remote On-Off Switching' automatically appears – otherwise to be reached via Code 451.
2. Press ↓-**key** to switch to Fig. ② – ↑-key to switch back. Number Two and the symbol 'external output release' are blinking. This figure means, that the key switch exclusively refers to the selection of control sources for the network air pressure (master control or individual pressure sensor). If this setting is selected, the parameterization 'external output release' appears automatically – otherwise to be reached via Code 210.
3. **Press** ↓-key to switch to Fig. ③ – ↑-key to switch back. Number Three and the symbole 'Remote On-Off' and 'external output release' are blinking. This figure means, hat the key switch refers either to the selection of switching sources for the readiness for operation of the compressor (green LED) or to the selection of control sources for the network air pressure (master control or individual pressure sensor). If this setting is selected, the parameterization 'external output release' appears automatically – otherwise to be reached via Code 210 – and 'Remote On-Off Switching' automatically appears – otherwise to be reached via Code 451.

4. **Press ↵-key** to overwrite the non-volatile EEPROM as per the blinking symbol and the corresponding additional parameterization figures, as described under the respective headlines, appear. Mode '0' does not make any sense here and is therefore not displayed.

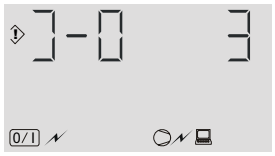
Remote On-Off control

①

②



③



④

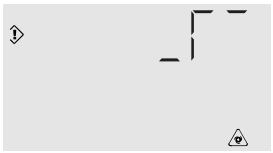
Each time the control is activated by parameterization, afterwards a blinking time value appears, which is described under *Network independent On-Off-memory (Auto-Restart).* Likewise it can be changed after having selected the On-Off-memory function.
This value is used as a start delay time, if the control was set to 'Remote' – via key switch or parameterization – with closed control room contact directly after a power failure.
If the compressor has to be switched on and off from a control room, the parameterization has to be set to the 2nd, 3rd or 4th of the following figures:

1. Enter **Code 451** as described under parameterization and the display shows Fig. ① on the left: The Zero on the top right blinks. This display means: On/off switching is only possible using the **keys** of the control unit.
2. Press ↓-**key** to switch to Fig. ② –↑**-key** to switch back. Digit One and the symbol 'Remote On-Off' are blinking. This display means: Neither the keyboard of the control unit nor the serial interface but exclusively the **Input for Remote On-Off switch (continuous contact)** are used for cut-in and cut-out (green LED) – see also Switching *Local-Remote* via key switch.
3. Press ↓-**key** to switch to Fig ③ –↑**-key** to switch back. Digit Two and the symbol ‚online' are blinking. This display means: the compressor is exclusively switched on or off via the optional **serial Interface 'RS485'**, plugable into the control unit – the keyboard and the input for Remote On-Off switch (continuous contact) are not considered – see also 'Switching *Local-Remote* via key switch' and 'RS485-Bus-Address setting'.
4. Press ↓-**key** to switch to Fig ④ –↑**-key** to switch back. Digit Three and the symbole 'Remote On-Off' and 'online' are blinking. This display means: The compressor is either switched on or off via the **Input for Remote On-Off switch (continuous contact)** or via the optional **serial Interface 'RS485'**, plugable into the control unit, but not by the keys of the control unit. If the continuous contact is opened, the compressor cut out – see also Switching Local-Remote via key switch. If the continuous contact is closed, switching on/off is possible via the serial interface – see also 'Switching *Local-Remote* via key switch' and 'RS485-Bus-Address setting'.
5. **Press ↵-key** to overwrite the non-volatile EEPROM as per the blinking symbol and if the above figure is selected the main display reappears. Otherwise, the figure shown under *Network independent On-Off-Storage (Auto-Restart)* point 3 appears.

If the compressor is set to a Remote-On-Off switch, at the bottom of the main display the corresponding symbol 0/I is shown. Then the compressor can only be switched on/ff from Remote. The Emergency Off function is not concerned. It remains unchanged.

Enable network independent ON-OFF memory (Auto-Restart)


①


②


③

Normally a compressor always assumes an OFF status directly after an electrical power failure.
However, after a power failure there is an option to automatically restart the compressor with a set delay time, also acknowledged in combination with a parameterization Remote On/Off – after mains return, automatically delayed – see also power failure protection – **repair**. This is done as follows:

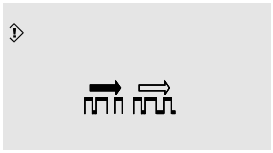
1. Enter **Code 134** as described under parameterization → and the display shows Fig. ① on the left: The 'line' at the top right blinks.
   This display means: no remembering of On-Off status (no automatic standby) after a power failure.
2. Press ↑ **or** ↓**-keys** to switch to figure ② on the left (press again to toggle back...): The 'curve' at the top right blinks. This display means: Remembering of the On-Off status even after a power failure (Auto-Restart).
3. **Press** ↵-key to overwrite the non-volatile EEPROM acc. to the blinking symbol. If the top symbol was selected, the main display is shown. Otherwise figure ③ on the left appears: The number 120 blinks. The quotation mark symbol here stands for seconds. Press the ↑ or ↓-key to change the value.
4. **Press** ↵-key to overwrite the EEPROM with the blinking value and the main display appears with the ⚠ at the bottom right.

Idling control for extremely short operation times (Change after-running time)

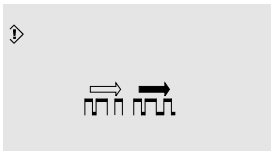
After an output phase the compressor switches to an idling phase before decreasing the system pressure and finally switching into stand-by. For compressors with special ventilation an additonal after-running time is necessary to avoid the formation of condensate in the compressor. The after-running time can be adjusted as follows:

1. **Enter Code 019** as described under parameterization → and the display shows Fig. ① on the left: The digit (here 1) blinks. The quotation mark symbol here stands for seconds. A run-out curve is indicated on the two right positions.
2. Press the ↑ or ↓-**key** to change the value. Above 119 minutes appear and the apostrophe symbol instead of the quotation mark symbol.
3. Press ↵-**key** to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.

Set continuous mode



①



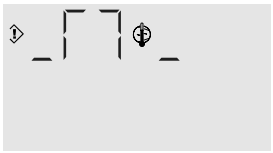
②

If pressure drops in relatively small receiver/pneumatic network volumes must be avoided at any price, continuous operation can be set as follows – if no continuous control was parameterized in connection with a single compressor:

1. Enter **Code 733** as described under parameterization → and the display shows Fig. ① on the left.
   The shading of the left arrow blinks. This means: automatic power economy operating mode selection.
2. **Press** the ↑ or ↓-key to change to Fig. ② on the left. (press again to toggle back...).
   The shading of the right arrow blinks. This means: continuous operation.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking symbol, and the main display from the selected symbol appears.

Anti freeze operation

(only in mode *ready for operation*)



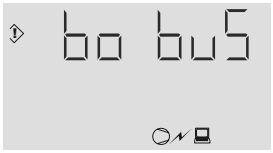
①

②

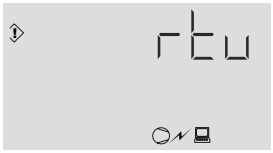
The compressor is set to automatically start an idling phase – in star mode i.e. without switching on a probably existing ventilator motor – from standby when the temperature drops to below +4°C. During this phase in the main display a thermometer blinks left of the temperature display. The idling phase is finished as soon as the min. after-running time or +20°C final compression temperature are reached.
This anti-freeze function can be switched off as follows:

1. Enter **Code 056** as described under parameterization → and the display shows Fig. ① on the left: the 'curve' left of the thermometer blinks.
   This display means: automatic idling phase in frost.
2. **Press** ↑ or ↓-key to change to Fig. ② on the left (press again to toggle back...) The 3x dotted line left of the thermometer blinks.
   This display means: no automatic running phase in frost, shown by means of the right dash as to the thermometer.
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking symbol, and the main display from the selected symbol appears.

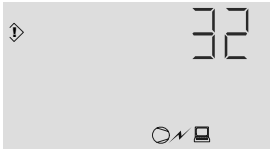
RS 485-Bus-Address



①



②



③

④

⑤

The control is already set for a bus coupler (BOGE-Bus-Address 32) for each compressor according to customer specifications – as e.g. for Profibus. If used another communication of RS485 then the following action is necesarry:

1. Enter **Code 830** as described under parameterization → the display shows one of the following fig. ① or ②.
2. **Press** ↑ or ↓-key to select the picture (bobus = BOGE-Bus, rtu = Modbus type RTU) and quit by ↵-key. Depending upon selection one of the two following fig. appears ③ or ④:
   With the BOGE-Bus only the desired address (flashing here 32) is to be selected and quit by ↵-key, while with the Modbus-RTU after confirmation of the address (flashing here on 0 = offline) by the key ↵, if address >0, still additionally the Baud rate and the data format are adjustable as follows fig. ⑤:
   first the number 96 (= **96**00 Baud) flashes – after confirmation by the ↵-key 8E1 flashes (8E1 = **8** data bits, parity check of **E**ven and **1** stop bit). By means of key ↑ or ↓ then the necessary combination can be selected (n = **n**ot parity check, o = **o**dd).
3. **Press** ↵-key to overwrite the non-volatile EEPROM with the blinking value, and the main display reappears.
   A blinking Online symbol refers to a fault in the RS485 connection.

Parameter overview

Code	Function	Page
019	Idling control for extremely short operation times	1.18
056	Anti freeze operation (only in mode *ready for operation*)	1.19
111	Set the compressor servicing interval and restart	1.13
134	Network independent ON-OFF memory (Auto-Restart)	1.18
210	External output enable	1.15
222	Set the motor servicing interval and restart	1.14
333	Set load cycles dependent servicing/inspection and restart	1.14
360	Change target pressure values (P_{max} and P_{min})	1.14
451	Remote On-Off control	1.17
733	Set continuous mode	1.19
770	Switching *Local-Remote* via key switch	1.16
830	Set RS 485-Bus-Address	1.20

General

The tables on the following pages give information on the possible causes of operating faults and measures for their rectification.

ATTENTION!
Ensure that any work required to rectify faults is only carried out by trained personnel or specialists.
Ensure that components which have a safety function are only set, repaired or exchanged by BOGE Service!

Please contact BOGE-Service at the following telephone number, if you have any questions.

✆ **770-448-5995**

Automatic monitoring of the control systems

All data is stored in a memory module (EEPROM).
If a fault occurs while the data stored in the EEPROM is being read, the control system will react as follows:

– The compressor is switched off.
– The following fault message appears in the display.

Fault

red

The control unit registers an **Error,** the compressor is immediately and without an idling phase – automatically shutdown, the error **Relay** drops and on the right next to the actual pressure value there blinks a number next to the red indicator lamp:

– the blinking number indicates the registered cause (see also message key table under error messages).

Acknowledge messages

Display the message – e.g. by pressing the **i-key**. Press ↵-key to cancel the display and acknowledge the message. The main display appears, if the cause for the fault was rectified.

RATIO

FAULT	Possible cause	Rectification
1 Excessive final compression temperature 	Ambient temperature too high	Employ suitable measures to improve the air inlet and ventilation in the installation room
	Cooling unit soiled	Clean cooling unit externally
	Insufficient cooling air quantity	Keep air inlet opening to the compressor clean; check to ensure that any existing cooling air duct systems are adequatly dimensioned
	Insufficient oil quantity	Top up oil
	Temperature sensor defective or wire break	Replace temperature sensor or repair the wire break
13 Frequency converter / motor 	Motor overload! Power input too high caused by undervoltage	Ensure correct voltage conditions: Constant voltage in accordance with IEC 38
	Insufficient cooling of motor / frequency converter	Ensure better cooling of motor / frequency converter: improve ventilation of the installation room; Clean cooling unit and supply air filter
	Motor soiled	Clean motor cooling air supply
	Excessive system pressure	Exchange oil separator cartridge
	Network pressure P_{soll} / P_{max} too high	Reduce line pressure to prevent compr. building up a compr. load above approved max. pressure
	PTC resistor defective or aged	Overhaul motor
0 Compressed air pre-processing (option)	External unit of the compressed air treatment signals malfunction	Service or repair compressed air treatment unit **Note:** This message does not lead to switch-off the compressor and the standard configuration

RATIO

FAULT	Possible cause	Rectification
4 Rotational direction (option) 	2 phases of power cable incorrectly poled (incorrect rotary field connected)	Change the 2 phases of the power cable
5 Pressure limitation 	Excessive pressure due to soiled oil separator	Replace oil separator cartridges
	Ball valve at compressor outlet closed	Open ball valve
6 Suction filter (option) 	Soiled filter cartridge	Clean or replace cartridge
	Defective low pressure switch	Replace pressure switch
7 Oil filter (option) 	Soiled filter cartridge	Replace cartridge
	Defective differential pressure switch	Replace pressure switch
8 Oil separator 	Soiled filter cartridge	Replace cartridge
9 System pressure build-up 	Air relief valve does not close	Check air relief valve and replace, if necessary
	Suction controller does not open	Check suction controller and replace, if necessary
	Leakage in system	Check system, overcome leaks
14 Temperature too low	Ambient temperature too low	Apply anti-freeze measures
15 Suction control defective	Vent valve / quick acting starting valve does not close	Clean valves or replace wearing parts
16 Network pressure transmitter faulty 	Network pressure transmitter defective or wire breakage	Replace network pressure transmitter or re-establish electrical connection

RATIO

FAULT	Possible cause	Rectification
18 Master control defective	Master control defective	Check supply voltage of master control. Parameterization of external output enable
25 Control unit EPROM /reconciliation error	Error loading software. Control unit defective	Reload software or replace control unit
26 Control unit Key (Off) O does not open	Control unit defective	Replace control unit
27 Control unit Key i does not open	Control unit defective	Replace control unit
28 Control unit Key (ON) I does not open	Control unit defective	Replace control unit
29 Control unit Key Enter ↵ does not open	Control unit defective	Replace control unit
30 Control unit Key ▲ does not open	Control unit defective	Replace control unit
31 Control unit Key ▼ does not open	Control unit defective	Replace control unit
32 Network press. transmitter faulty	Network pressure transmitter defective or wire breakage	Replace network pressure transmitter or re-establish electrical connection
33 System press. transmitter faulty	System pressure transmitter defective or wire breakage	Replace system pressure transmitter or re-establish electrical connection
34 System press. transmitter faulty	System pressure transmitter faulty	Replace system pressure transmitter

RATIO

WARNING	Possible cause	Rectification
0 Compressed air pre-processing (option)	Warning	See operating instructions for compr. air pre-processing
10 Motor servicing due 	Servicing intervals	See operating instructions for servicing
11 Compressor servicing due 	Servicing intervals	See operating instructions for servicing
15 Suction control and / or ventilation	Warning	Check suction controller Check solenoid valve Check continuous output control (option)
21 Receiver inspection due or replace wearing parts 	Servicing intervals	Inspect receiver acc. to local rules and/or replace wearing parts