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BOGE
COMPRESSED AIR SYSTEMS

Functional description

FOCUS for screw compressors

As of 08.02.2011
Software version V1.15
Document version V23

GLC CERTIFIED ISO 9001

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Overview of revisions:

Index	Datum	Software-No.	Chapter	Description
21	04.11.2010	1.1.14	Unscheduled air requirement	Revised
23	08.02.2011	1.1.15	Leakage Monitor	Added
			Collection of Leakage Values	Added
			Table of messages and List of messages	Message 45 revised

Index

1 Installation

The FOCUS is a compressor control unit.
It is part of the compressor installed into the switch cabinet and designed to control compressors.

Prior to commissioning and starting any kind of work at the control, please read the control and compressor manuals carefully. Especially note the **safety information in chapter 1** of the **compressor manual**.

1.1 Supply input

Terminals A1 and A2 for 24V AC/DC

Rating: 24V +/-10%, 50/60Hz, 14 … 16 W according to set-up
24V DC +/-10%, 0.4 … 0.8 A according to set-up

An interruption of the power supply is effected by means of the power disconnecting device of the compressor.

1.2 Modules

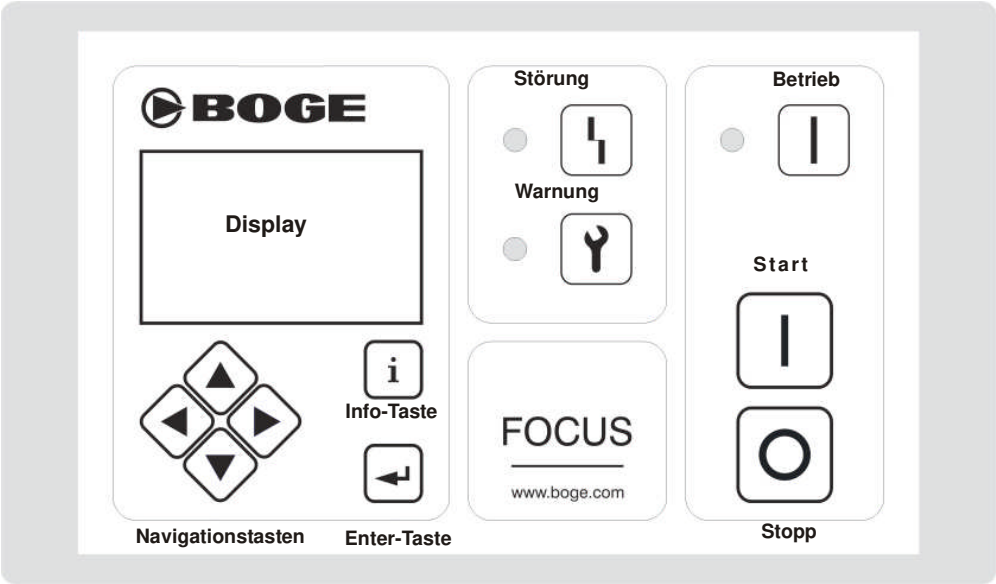
The basic set-up of the FOCUS comprises the basic module and the keyboard with display unit (TAN).
Amongst others the following modules are additionally available:

FC module	for frequency-controlled compressors and compressors with soft start
Analogue output module	4-20mA output for master control suitable for frequency-controlled compressors
RS485 module	second RS485 interface for connection of additional compressors, if standard module is used otherwise
Dryer module	for compressors with integrated dryer
Relay module	with changeover contact relay (the functions are selectable by means of a rotary switch).

Interconnection of modules is to be made using suitable power lines and **in voltage free conditions only**!

2 Control unit

The display elements comprise a graphic display and three LEDs coloured either green for indication of operational readiness, yellow for maintenance alerts, or red for fault signalling.



◄ ► Navigation keys
Navigation in the menu, changing of displays, scrolling of pages in the parameter display.

▼▲ Navigation keys
Navigation in the menu, changing of display level (e.g. to the status display of an integrated dryer, navigation in the parameter display, setting of values.

Info key	Display of faults and maintenance messages, log book, quitting of settings
Enter key	Confirmation of inputs, selection of parameters, forced idling, enable setting of FC (*frequency converter*) parameters without motor release
Off-key	Acknowledging when switching on the control, switching off the compressor, switching off forced idling
On-key	Switching on the compressor, forced idling
• **Warning/Maintenance (yellow LED)**	Flashing: Maintenance is due – does not cause an automatic shutdown. Lit: Message was pre-acknowledged, the reason is still identified.
• **Fault (red LED)**	Flashing: Fault present, compressor automatically shut off. Lit: Message was pre-acknowledged, the reason is still identified.
• **Operation (green LED)**	Flashing: Off-button was already actuated and compressor is in idling operation until the system pressure is decreased. Lit: Compressor is switched on
Emergency-Stop button	The Emergency-Stop button interrupts the power supply for the contactor coil. The control is still energized and generates a corresponding display

3 Operation

Prerequisite: The compressor must be electrically and pneumatically connected, the power supply voltage must be turned on and the ball valves and/or balanced disc stop valves between compressor and compressed air receiver must be opened.

3.1 Switch on the control

After switching on the compressor supply voltage, the names of the control unit, the manufacturer and the version number – as described under version display – are displayed.

First a parameter adjustment between basic module and TAN is performed resp. and if applicable the registration of connected and not yet registered additional modules.

After completion of this process, **either** the O key symbol on the display starts flashing which is to be acknowledged by actuating the O key prior to leaving the display;
or auto restart and/or remote ON-OFF are activated and after return of the voltage (network power outage) a **Countdown** is being displayed, ordinarily starting with the preset auto restart time* [s]. After expiry of the response time, the compressed is reset to the Ready state and starts automatically as soon as the relevant conditions are met.

** in case of unduly frequent and sequential motor starts the restart time will automatically be prolonged for a temporary period.*

If, when switching on the voltage, a fault is present, this fault is directly being displayed after parameter mapping (also see fault / warning).

3.2 Switch on the compressor

At first **OFF** should be displayed in the bottom frame – the status display of the compressor.

If this is the case, actuate the I - key to switch the compressor to the **Ready** status.

A green LED signals that the compressor is ready for operation and the pressure control is active – as long as no „Timer-Off“ is due or an external pressure control was parameterized.

If **EMERGENCY-STOP** is displayed for the compressor status the Emergency-Stop button has to be unlocked first.

If the status display shows **Fault**, the control is faulty and the malfunction has to be corrected first (see also *chapter 7 Warning message / Fault message*).

3.2.1 **Ready**

If the compressor status **Ready** is displayed, the compressor is in the „ready-for-operation“-status. That means that the compressor automatically (re)starts pressure, temperature and time controlled – as long as the conditions to do so are fulfilled.

3.2.2 **Run-up**

The compressor motor is started and run up as already described under ‚Ready’.
The status display changes from **Ready** to **Run-up.**
To be able to do so the system pressure at the compressor must be decreased and the motor spinning time finished.

For a star/delta contactor combination applies: First the star contactor and 20ms later the mains contactor is switched on. The display **Run-up** signals the corresponding status of the control. It is also being displayed during anti-freeze operation.

3.2.3 **Load operation**

The run-up or star phase resp. end after termination of the run-up phase before the feed valve is actuated by means of the control unit.

Depending on control configuration of the machine, it switches to delta operation with **load operation** being displayed, whereas with frequency controlled machines the percentage utilization of the frequency converter is displayed as a **bar graph**.

3.2.4 **Idling**

If the set maximum pressure of the compressor is reached in the load run the control switches to **Idling**. Accordingly **Idling** is shown in the status display. As a result an automatic system pressure decrease is effectuated. If no after-running time is set (default: 0sek) the **Idling** phase is finished as soon as the system pressure value drops below 1.3 bar (if applicable + parameterized max. booster pressure) – provided the automatic limitation of start numbers allows it – and the compressor changes into the **Ready** status.

If the net pressure drops below the set minimum pressure (P_{min}) during the idling time, the compressor control automatically switches from **Idling** to **Load run** – and the compressor continues with the output.

3.3 Switch off the compressor

With the  -key or via Remote-Off the compressor is switched off.

If this is done within a load or idling phase a green LED appears during idling waiting for the system pressure to be released before changing to the **Off** status and causing the green LED to switch off. During this idling phase no actuation signals will be registered

3.4 Maintenance

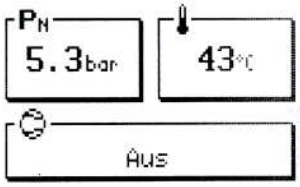
When operating the control only the battery voltage has to be minded. In case it drops too low a warning message is created. In this case the battery must be replaced.

The TAN display can be cleaned using a moist but not wet cloth. As cleaning agents commercial quality household detergents for greasy surfaces are suitable.

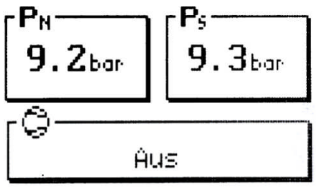
Apart from that the control is maintenance-free.

4 Display information

4.1 Main display



1)



2)

This is the main display in the control menu. Here the net pressure, the final compression temperature and the compressor status are displayed (1).
By pressing the **arrow key ►** the system pressure (2) is displayed instead of the final compression temperature!

Net pressure	P_N	Shows the current net pressure.
Final compression temperature		Shows the current final compression temperature
System pressure	P_S	Shows the current system pressure.

Compressor status	**Meaning**
Off	Compressor is switched off – Anti-freeze operation is blocked
Ready	Compressor is Ready and starts automatically as soon as the conditions are fulfilled.
Run-up	Compressor is in run-up phase (star switching if applicable).
Load operation	The solenoid is set for supply. The motor runs in delta if need be.
Compressor workload [%]	Display of air requirement for frequency controlled compressors. The solenoid is set for supply.
Idling	The solenoid is not set for supply (currentless) and the motor runs.
Fault	The control has registered a fault and caused the compressor to switch off. Make sure to remedy the fault prior to continuing operation!
Emergency-Stop	The Emergency Stop pushbutton is engaged. A switching off should **preferably** be effected by using the O- key. The emergency stop should only be activated in **case of danger**!

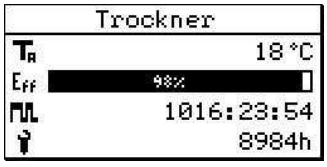
If a dryer module is connected, the actuation of the **▼▲-keys** in display 1 or 2 of the main display effectuates that instead of the compressor status the tendency display of the dryer is displayed.

The tendency display is an indicator for the relative humidity of the compressed air.
With a relative humidity of 25% the display is exactly in the centre.
If the cooling temperature drops to <= 0°C it is entered into the calculation. The display then moves to the left with decreasing temperatures (into the direction LO).

If the arrow key ▲ is pressed, the compressor status is displayed again.
Pressing of the arrow keys ◄ ► leads to the next display.

4.2 Dryer

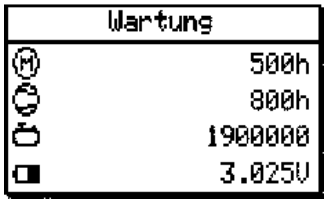
When connecting the dryer module to the control, an additional page with the headline „Dryer“ is displayed in the menu sequence. On this page the operating data of the dryer are displayed.



Room temperature	Current ambient temperature
Dryer efficiency display	Ratio between load time and total running time in %
Operating hours	Shows the operating hours of the dryer
Service interval counter	Shows the operating hours until the next servicing

4.3 Servicing

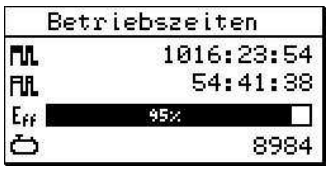
With the next actuation of the ► -key you get to the servicing display.
Here the information concerning the servicing times are displayed.



Next motor servicing (h)	Shows the operating hours until the next motor servicing
Next compressor servicing (h)	Shows the operating hours until the next compressor servicing
Next receiver servicing	Shows the number of load changes until the next receiver servicing
Current battery voltage	Shows the current voltage of the battery in the main module for its real-time clock.

4.4 Operating times

With the next actuation of the ► -key you get to the operating times display**,**
on this menu page the operating times of the compressor are displayed.

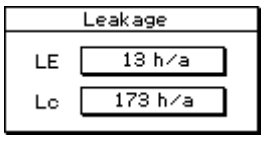


Operating times

Motor running time	Shows the total operating time of the compressor motor in hours, minutes and seconds.
Idling	Shows the proportional time in hours, minutes and seconds in idle or run-up mode.
Efficiency display	Shows the ratio between load run and total running time since the last relevant Reset.
Load cycles of internal receiver	Counts the effected load cycles of the internal combination receiver (One cycle consists of 1 x output and 1 x no output each)

4.4.1 **Leakage Monitor**

Pressing arrow key ▲ causes the leakage page to appear.



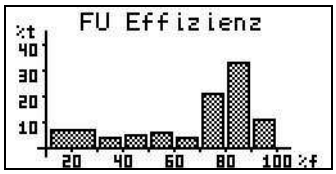
This serves to illustrate the probable (full) load hourly operation portion of the compressor intended for compensation of annual leakage losses – also see collection of leakage values.

Value ‚LE … h/a' is based on single measurement.
Value ‚Lc … h/a' or ‚LC … h/a' resp. is based on continuous measurements.

Re-actuation of arrow key ▲ serves, in the absence of a speed control, to go to the *Operating Hours* page – pressing arrow key ▼ will in any case cause the *Operating Hours* page to reappear.

4.4.2 **FC Efficiency**

If this is a compressor with variable speed drive (frequency converter), you reach the page FC efficiency by pressing either ▼ or ▲.



This page illustrates the percental usage averaged over the motor runtime.
After pressing one of the arrow keys (▼ or ▲) again, the page *Operating time* is displayed.

4.5 Info # 1

Here the information as to the compressor settings is displayed.

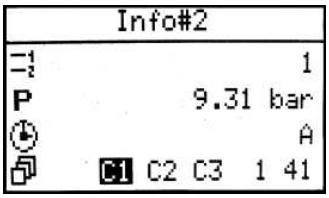
Symbol	Function	Possible indications	Meaning
		1:19200;8N1	The RS485 interface is parameterized as a slave: *address, baud rate, data bits, parity, stop bits* - up to this point no communication has taken place as yet.
		O.K.	The last communication has taken place less than 1 minute ago
	Status RS485	Time (e.g. 12 min)	This is where the period of time is displayed, when the last – valid – communication took place. (up to approx. 7 days)
		C2 [C3 C4]	When parameterized as master or overriding control, this serves to display the compressors with which communication is taking place. Flashing of a combination warns of a faulty communication.

Symbol	Function	Possible indications	Meaning
I/0	On-Off	Local	A keyboard serves to switch on/off the compressor.
		Remote	The compressor is switched on/off by remote control.
		Off	The compressor is presently switched off.
		On	The compressor is presently switched on.
		🔑	Display of the key symbol means that a key switch enables on-site or remote switching
	Output release	internal	Release is actuated by means of a pressure sensor.
		external	Release is actuated by means of a contact or the bus
		yes	Release okayed
		no	No release okayed
		🔑	Display of the key symbol means that a key switch enables on-site or remote switching
	Auto Restart	n/a	Auto Restart is not parameterized
		Time (e.g. 30 sec)	Parameterized time for Auto Restart

Changes to the displayed settings have to be accomplished by means of the parameter settings, if applicable.

4.6 Info # 2

The information to the control settings as master control resp. the current status of the integrated timer are displayed here.



Pressure range	Activated pressure range
Net pressure	Current net pressure
Timer	- A-Z active timer channel - n/a no channel active
Priority sequence and time next change of priority *	Set priority sequence, active compressors and time in h and min until next change of priority *.

*) The priority sequence is only displayed if the number of compressors in the basic load switching is above 1. In case the number of compressors in the BLS is set to 1, **n/a** is displayed here.

The display of the priority sequence shows the currently effective sequence for selecting the compressors. Depending on the setting the priority sequence is specified either by the basic load switching or by the timer.
For each parameterized compressor the current output signal status, the current priority level and the time until the next priority change, with switched-on BLS, is displayed. If only the timer is active (cyclic changing time set to 0) no time is displayed.

Meaning:

C1 C2 C3 means, that the compressors 1-3 are considered and the sequence 1, 2, 3 is chosen - in this case none of the compressors receives an output signal.
C1 C3 C2 means as in the first example, that the compressors 1-3 are parameterized although they are selected in the sequence 1, 3 und 2 and furthermore compressor 1 receives an output signal in this case. (The output signal status is shown by means of a black background in the graphical presentation of the compressors in the display.)

Changes to the displayed data can be accomplished by means of settings of parameters 70 and 71 or by Timer settings. (cf. parameterizable settings)

4.7 Date / Time

This menu page shows the current setting of the real-time-clock.

The time is displayed in hours, minutes and seconds and the date with day of the week, day, month and year.
In case of a switched-off power supply the real-time-clock is operated by its battery – provided the plug-in jumper contacts arranged next to it are connected and their voltage is sufficient (see also chapter 4.3 Servicing).

To be able to set time and date only the ↵ - key has to be pressed for approximately 2 seconds, The cursor jumps to the time display and the place value for hours starts blinking.

This value can only be adjusted by means of the ▼▲-keys.

With the ↵-key the input is acknowledged and the cursor moves to the next field.
Proceed the same way with all other place values until all values are correctly adjusted.

In case a value has to remain unchanged just actuate the ↵ -key, to jump to the next value.

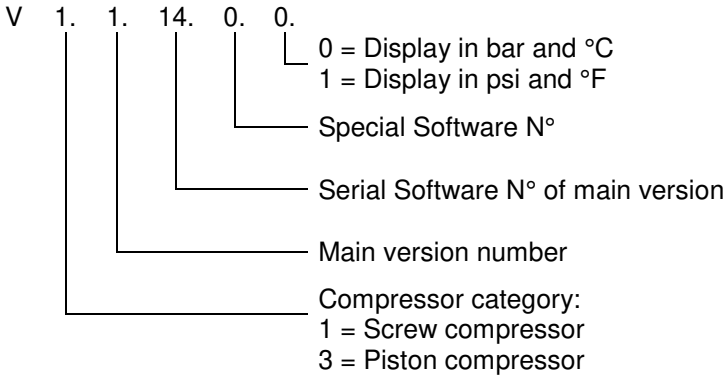
To leave the time adjustment, actuate ↵ -key until none of the place values is blinking any longer.
Actuate ◄ -key to reach the previous page or actuate the ► arrow key to go to the next page.

If the i -key is actuated while adjustments are made to the real-time-clock this setting is left without accepting the parameterized changes.

4.8 Display of version

The version display can be reached in the menu by pressing the ◄ or ► keys.
Here the name of the control, the software number and the manufacturer are displayed.

The Software N° is subdivided as follows:



If the ▼-key is pressed now you get to the **Module-Info** display.

Here the addresses and the installed software versions of the connected modules are displayed. The first display refers to the basic module (Address: 0), all other connected modules can be displayed by actuating the ◄ ►-keys.

Module		**Address**	**Position of switch**
Basic module	-	0	--
TAN	-	1	--
FC module	-	10	0
FC module for connection of soft starters	-	11	1
Dryer module	-	20	--
RS485 module	-	30	0
Analogue output module (only in conjunction with frequency converter: workload)	-	50	0

In case the display of a module flashes, the communication with this module is faulty.

You can leave the Module-Info by pressing the 

-key.

5 Settings

5.1 Entering of codes in general

Actuating the arrow key ◄ leads from the main display 1 to the **version display**.

If now the ↵-key is actuated, a display is shown asking you to enter a 5-digit code (see code list.) The first place value of the code is blinking. By means of the arrow keys ▼ and ▲ a digit can now be changed.

By actuating the ↵-key or the ►-key the cursor jumps to the next value and the value can be changed accordingly.

Once the last digit has been set the code is acknowledged by actuating the ↵-key.

According to the entered code either windows for various settings or a parameter list opens.

When entering the second ... fifth digit actuating the i-key causes an erasing of the previous digit, so that it can be entered again.

Actuating the i-key when entering the first digit the code setting is left and you return to the version display.

CODE	**Meaning**
17391	Parameter editing (partially)
00000	Parameter display / access previous code
00111	Setting/Resetting servicing intervals
00988	Parameter restoring
00798	Timer settings

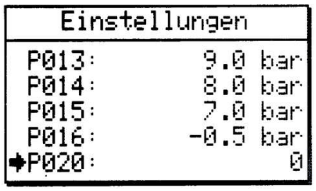
If the Parameter Editing Code was entered it is possible to return to the previously left parameter list within 15 minutes after having left this list, without having to enter the code once more.

5.2 Parameter list

If the code for the parameter list is entered the parameters can be processed.

An arrow at the beginning of the line shows where the cursor is currently positioned and if a value under this code can be changed.
If the arrow is displayed in the form of an outline ⇨, this means that merely an info value is shown; if however a filled arrow ➔ is displayed, the respective value may be altered.

In the parameter setting actuating the ▼ and ▲-keys makes the cursor move one parameter forwards or backwards. Use ◄ and ►-keys to scroll to the previous/next page.



To leave the parameter list actuate i -key and you get back to the main display.

If you are in the adjustment range of a parameter, it can be left again by actuating the i-key. You have to actuate the i- key once more to close the list.

5.3 Set parameters

Opening of the parameter list by means of the above mentioned code.
If the cursor points at the parameter which is to be changed, e.g. maximum pressure in the pressure range 1 (P012), this selection is acknowledged by actuating the ↵ - key.
If a digit (e.g. 9 bar) is blinking on the right side of the parameter, the desired value can be set (e.g. 10 bar) by actuating the ▼▲- keys.

By actuating the ↵ -key this input is acknowledged and stored!

Actuating the i -key at this place causes a leaving of the setting without accepting the changes.

5.4 Parameters

The setting of the parameters can be accomplished as described in chapter 5.3 (see also 5.2 parameter list).

5.4.1 **P001 Language**

Here the language for the user interface can be selected:

At the moment the following languages are supported:

German	DE
English	GB
Italian	IT
Russian	RU
Finnish	FI
Danish	DK
Lithuanian	LT
Swedish	SE
Polish	PL
Spanish	ES
Portuguese	PT
French	FR
Dutch	NL
Latvian	LV

5.4.2 **P012 P_{max} Pressure range 1**

Pressure range 1 is the default pressure setting for the compressor.
Here the upper pressure target value for pressure range 1 is set. As soon as the net pressure has reached P_{max} the compressor changes from load run to idling.
If P_{max} is set such that P_{min} is larger and/or the minimum hysteresis (P011) is not met, the procedure is continued until forced editing of P013 is effected after acknowledgement by means of the ↵ - key.

5.4.3 **P013 P_{min} Pressure range 1**

Pressure range 1 is the default pressure setting for the compressor.
Here the bottom pressure target value for pressure range 1 is set. If the compressor is in the Ready state and the net pressure drops below P_{min}, the compressor starts with the output.

If the pressure range selection is effectuated by a master control or the external contact you have to observe when setting the pressure ranges, that in case of a power failure or fault of the master control, the compressor control eventually falls back on this pressure range.

5.4.4 **P014 P_{max} Pressure range 2**

Pressure range 2 offers the possibility for pressure decreases and the value must not be set above that of pressure range 1.
Here the upper pressure target value for pressure range 2 is set. As soon as the net pressure has reached P_{max} the compressor changes from load run to idling.
Pressure range 2 is only active if corresponding adjustments of the timer have been made and/or the external contact for the pressure range selection is active.
If P_{max} is set such that P_{min} is larger and/or the minimum hysteresis (P011) is not met, the procedure is continued until forced editing of P015 is effected after acknowledgement by means of the  -key.

5.4.5 **P015 P_{min} Pressure range 2**

Pressure range 2 offers the possibility for pressure decreases and the value must not be set above that of pressure range 1.
Here the lower pressure target value for pressure range 2 is set. As soon as the net pressure drops below P_{min}, the compressor starts with the output.
Pressure range 2 is only active if corresponding adjustments of the timer have been made and/or the external contact for the pressure range selection is active.

5.4.6 **P016 Delta P (frequency converter target value)**

The target value for the frequency converter is set here. The set value (in bar) is a relative value. It is added to the current P_{max} and therefore it must have a negative algebraic sign.

5.4.7 **P020 Auto Restart**

Switching On/Off of the Auto Restart function (network independent on-off memory).
Normally the boot display is shown after a power failure, which must be acknowledged by actuating the  - key, before the control displays the Off-status and the alarm relay returns to the status “no fault”.

If the Auto Restart function is active and the compressor was previously switched-on an adjustable count down is started after power recovery (Auto Restart time P021).
When this time is elapsed the compressor automatically returns to the Ready status. The pressure control is active and on demand the compressor resumes the output.
If P020 is set to the value **1** and Auto Restart is **activated**. If the value **0** is set the Auto Restart is **deactivated**.
When switching-off the compressors with the Emergency-Off button the Auto Restart function is not active.

5.4.8 **P021 Auto restart time**

The time set in seconds is the time that elapses after a power failure, before the compressor starts again with activated Auto Restart.

5.4.9 **P022 Short stop time limiting value**

The time set in seconds is the time that should elapse at least after a motor stop before the switch-on pressure value of the air supply network is reached or dropped below again.
To be able to do so the FOCUS control constantly monitors the air supply network and “learns” the necessary data. Thus these data are automatically kept in case of net structure changes.

5.4.10 **P031 After-running time**

Period in which the compressor minimally remains during the idling phase after load operation prior to switching to the **Ready** status – does not apply when actuating the Off button.
This value is normally set to zero. Under special circumstances increased after-running times may be necessary, which can be set at this place.

5.4.11 **P032 Anti freeze protection**

Here the automatic anti freeze protection can be disabled.

If the compressor is in **Ready** status and the oil temperature (final compression temperature) drops below 5°C, the compressor starts automatically and runs in idling until the oil temperature reaches 20°C again.

If P032 is set to the value **1** the automatic anti freeze protection is **deactivated**, if the value **0** is set the anti freeze operation is **active**. The value 0 is given as default value.

5.4.12 **P034 Continuous operation**

If pressure losses have to be avoided at any cost in case of relatively small receivers or compressed air net volumes, a continuous operation can be activated here.
In case of an activated continuous operation the control never switches back to the **Ready** status. The compressor constantly runs in **Idling** if it is not delivering compressed air.
The value **1** means that the continuous operation is **active**, **0** means that the continuous operation is **deactivated**.

5.4.13 **P042 Maximum booster pressure**

With this parameter the booster pressure is set with which the compressor is supplied. In case of possible fluctuations the peak value has to be entered.

Normally the atmospheric pressure (1bar, absolute) serves as booster pressure. For compressors with a booster pressure out of a compressed air network this pressure has to be added by the control to the pressure limitation values of the rotational direction monitoring and ventilation monitoring.
In case of monitoring of the rotary direction the actual system pressure value is registered at the motor start and provided with an adjustable Offset.
For the function system pressure decrease / monitoring - switch off and run-up lock a system pressure threshold of 1.3 bar plus max. booster pressure is taken into account.

5.4.14 **P044 Message type oil filter**

With this parameter it is determined whether a pending message of the oil filter monitoring is defined as warning or fault. This setting influences the control performance. Whereas a message is created in case of a warning the compressor is additionally switched off immediately if this parameter is defined as a fault.

In this case setting **1** means **fault** and setting **0 warning**!

5.4.15 **P050 Modbus address**

The set value 0-248 indicates the Bus address of the RS485 interface on the basic module for the communication with an external Bus system – e.g. a master control.
For the settings of the integrated BLS (Base Load Switching) the value 0 is available for the master. Additionally connected compressors have to be specified with the values 2 – 4.
For other applications the address can be matched with the requirements. All addresses from 1-248 are possible.

☝ This address must be unique in the complete system.

5.4.16 **P051 Modbus baud rate**

The value shown here indicates the data signalling rate [Bits/s] of the RS485- interface of the main board for the communication with an external Bus system – e.g. a master control.

☝ For all appliances in the bus system this value must be the same.

5.4.17 **P052 Modbus frame**

The protocol frame is determined here. 8 data bits are transmitted and the parity can be selected (O = Odd), E = Even or N = None), as well as the number of stop bits. (1 or 2)

☝ For all appliances in the bus system these values must be identical.

5.4.18 **P053 Modbus address (module)**

The set value 0-248 indicates the Bus address of the RS485 interface on the basic module for the communication with an external Bus system.
0 stands for master, additionally connected compressors have to be specified with the values 2- 4.

☝ This address must be unique in the complete system.

5.4.19 **P054 Modbus baud rate (module)**

The value shown here indicates the data signalling rate [Bits/s] of the RS485- interface of the module for the communication with additional compressors.

☝ For all appliances in the bus system this value must be the same.

5.4.20 **P055 Modbus frame (module)**

The protocol frame is determined here. 8 data bits are transmitted and the parity can be selected (O = Odd, E = Even or N = None), as well as the number of stop bits. (1 or 2)

☝ For all appliances in the bus system these values must be identical.

5.4.21 **P060 Contact type compressed air purification**

By changing this parameter it is determined whether the type of alarm for the compressed air purification is a break contact or a make contact.

0: break contact
1: make contact

5.4.22 **P061 Message type for compressed air purification**

With this parameter it is determined whether the pending message of the compressed air processing is defined as a warning or as a fault. This setting has an influence on the performance of the control. Whereas in case of a warning only a message is released, the compressor is additionally switched off at once when this parameter is defined as a fault.

0: Warning
1: Fault

5.4.23 **P063 External release**

The kind of external release is set by this parameter.

Setting	**Meaning**
0	Internal release
1	Release via contact
2	Release via external BUS and in case of a malfunction via contact.

If a RS485 module is used and the parameter P053 parameterized to an address above 0 - its rotary switch must point to zero in any case – it serves prior to the standard BUS as an external output release.

5.4.24 **P064 Monitoring of an external release appliance**

The parameter P064 is relevant if the pressure control is effectuated externally via the digital input and compressed air has to be available continuously – i.e. no switch-off during the night or on weekends seems to be sensible.

If the parameter P064 is set to the value **0** the monitoring of external output release is **deactivated,** if the value **1** is set, the monitoring is **active**.

In case of activated monitoring the FOCUS automatically switches to internal pressure control, as soon as a fault of the external control is registered.

5.4.25 **P065 Remote Start- Stop**

This parameter determines the ON/Off switching function of the control via TAN, a potential-free contact or the Bus. In case the parameter is selected unequal 0, a switching On or Off via TAN of the FOCUS is no longer possible.

Setting	**Meaning**
0	The On/Off switching is effectuated solely by the control keyboard (local)
1	The On/Off switching is effectuated solely by the input Remote-Start-Stop-switch (continuous contact)
2	The On/Off switching is effectuated solely by the BUS interface,
3	The On/Off switching is effectuated solely by the continuous contact – release function – and via the BUS interface, however not via the control keyboard.

5.4.26 **P066 Key switch**

The function of the key switch is set here:

Setting	**Meaning**
0	The key switch has no function, it is deactivated
1	When actuating the key switch, the function Remote-Start-Stop is activated

Setting	Meaning
2	When actuating the key switch the external output release is activated
3	When actuating the key switch both the external output release as well as the Remote-Start-Stop function are enabled.

The settings for external output release (P064) and Remote-Start-Stop (P065) have to be effectuated separately under the corresponding parameter numbers.

5.4.27 **P070 Number of compressors**

Settings 2, 3 or 4 serve to activate the basic load switch – see also 6.8 Basic load change with additional compressors.

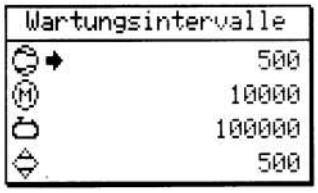
5.4.28 **P071 Interval time Base Load Switching**

This parameter serves to determine the time intervals at which the priority of the compressors is to be changed. Settings from 0 to 250 hours are possible.
If the cycle time is set at 0, no cyclic change will take place. The consecutive priorities can however be controlled by a timer (see also 6.8 Basic load change with additional compressors).

5.5 Grouped parameters / parameter management

5.5.1 **Servicing interval**

If the code **00111** is entered, a display for the servicing intervals is opened.
The servicing intervals for the compressor, the motor and the receiver are set here. If a dryer module is connected the servicing interval fort he dryer can be set here as well.



The servicing interval for compressor, motor and dryer is specified in hours, for the receiver the load cycles of the internal receiver are counted (One cycle consists of 1 x output and 1 x no output each)

With the ▼▲- keys the corresponding servicing interval is selected and acknowledged by means of the ↵ - key. Now the digit starts blinking and can be changed using the ▼▲-keys. Only after having acknowledged and entered the value by means of the ↵-key the new servicing interval is accepted and the corresponding down counter restarted.

By means of the i -key this setting can be left without saving the changes or the counter reading.

The display of the servicing intervals can also be left by means of the i -key.

With the setting of 2,000,000 receiver load cycles this down counter is deactivated.

5.5.2 **Parameter factory setting**

In case somebody has changed any parameters and wants to recover a functionally safe status the factory setting resp. commissioning setting can be restored.

To do this the compressor must be in the OFF status.
Only then the code **00988** can be entered.

In the displayed window you can read: "**Restore settings?"** and you can select either **Yes** or **No**. Should the saved parameters be restored, you can use the ▼▲- keys to select **Yes** and acknowledge by means of the ↵ -key.

Now the current data on the basic module are overwritten with the factory-set values.

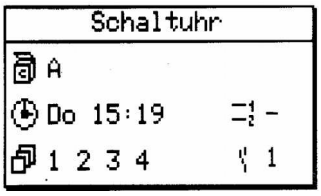
5.5.3 **Base load switch with additional compressors**

As of version 1.11 the settings for base load switching (BLS) are made by parameters ' P070 Number of compressors, P071 Interval time Base Load Switching" and P012 to P015 (P_{max} and P_{min} of pressure ranges 1 and 2) – see also 6.8 Basic load change with additional compressors.

5.5.4 **Timer**

By entering code **00798** the timer can be adjusted.

Having entered the code you get to the selection of the switch channels.



This is shown by the blinking of the first letter in the top line.
All in all 26 channels from A-Z are available. The channel can be selected using the ◄ ► -keys and acknowledged by actuating the ↵-key.

First the weekday starts blinking. The desired weekday can be selected using the ▼▲ -keys. One timer channel is **deactivated**, if two dashes (**--**) are set instead a weekday.

By pressing the ↵-key the input is acknowledged and the cursor jumps to the display of the hours.

Using the ▼▲ –key this value can now be set as well and acknowledged by means of the ↵-key. The same applies to the minutes.

Next the priority sequence of the compressors (see also chapter *6.8 Basic load change with additional compressors*) can be selected. Each combination of the numbers 1- 4 is possible.

The priority sequence ‚0000' causes that from the corresponding point of time the output signal is cancelled for all compressors – see also *Unscheduled air requirement*.

The display ‚----' effectuates that the timer with this channel does not influence the priority sequence but only accomplishes other functions (see below). Thus it can be used with other cyclic changes according to the chapter *6.8 Basic load change with additional compressors*.

By actuating the ↵-key the cursor now jumps to the selection of the pressure range.

1, 2 or "-" ranges are available and the selection can be acknowledges pressing the ↵-key.

The pressure ranges 1 and 2 can be set by means of the parameter P012-P015, "-" means that no pressure range change is effected by this timer channel. Either the pressure range of the previously active channel is kept or a pressure range is selected via an external contact or via a serial interface.

Last the potential-free contact of the basic module terminals ‚14/15' is determined. Available are: 1 (contact closed) or 0 (contact open).

By actuating the ↵- key the display fort he channel starts blinking again and by using the ◄ ► -keys another channel can be selected and adjusted as described above.

If the i - key is actuated during the processing of a channel function the current change is not saved.

In the mode ‚Selection of the switching channel' the actuation of the i-key brings you back to the main display.

Unscheduled air requirement

If compressed air is required while priority sequence 0000 is active, then there are the following possibilities:

a) On the ready (master) compressor (green LED is on) can to bypassed the clock off function by (secound) pressing the I- key. In such a case, the control accesses the priority sequence of channel A as well as pressure band 1. For this reason, priority sequences **0000 and ---- can not and may not** saved under channel A.
In this instance, this condition is cancelled by the next timer channel with an active priority sequence or by actuating the O-key - and after them the master was ready again (green LED is on too) by pressing one times the I- key.

b) Depending on the setting of remote control mode - adjustable by parameter 63 – timer channel A can be selected by contact or data bus.
The priority sequence of channel A remains active until the external signal is withdrawn.
In case of active basic load switch this signal is only to be fed to the master control – see also chapter Base load switch with additional compressors.

Remark:

This function is also effective in case of non-activation of channel A (weekday **—**).

6 Functions

6.1 Motor switching limitation

Motor switching limitation is only active when the air requirement makes it necessary, i.e. after the "Motor start count per time base" is reached before time.
Only then does it switch from intermittent to a limited continuous operation or an automatic Restart after power failures is delayed correspondingly.

The control unit calculates the through time so that on the one hand the maximum allowed switch count per hour can not be exceeded, and unnecessary idling times can be saved on the other.
The minimum time base is 12 minutes. It is created automatically by the control unit according to the given maximum switch cycle rate per hour.

6.2 Power failure cycle protection

If the function "Auto-Restart" is activated it is registered after an automatic motor restart following a short power failure (control voltage), if the motor start number would be too high after another start at the current moment and a possible start would probably be delayed. For the calculation the power failure times – provided the real-time-clock is connected (via plug-in jumper of the basic module) and its voltage (see also chapter *4.3 Servicing*) is sufficient – are considered.

This is shown in the Countdown display by means of a once increased Auto Restart time.

6.3 Motor spinning time

For motors with less than 15 switching cycles per hour the control unit reserves a spinning time of 20s during contactor operation after switching off the motor contactors. A switching-on of the motor is disabled within this period of time.

6.4 Star phase time control

To reduce starting current when starting the motor by contactors it is first operated load-free in star phase control and after a short time in delta control. The star time is tailored for each compressor type and visible in the control unit in parameter P030.

6.5 Pressure range selection

If an optional RS485 module is used as a slave (Modbus address unequal Zero) the pressure range is exclusively determined by the master of this bus system – irrespective of the live bit.

If the digital input of the basic module terminal ‚42' (input reference terminal: 31) is used, pressure range 2 can be selected or released by disabling.

If the standard modbus is used to select the pressure band, pressure band 2 can be selected or released by setting bit 3 (Write Register Address 1) – irrespective of the live bit –. The internal timer clock will have no further influence on the pressure band.

If the internal timer clock is used to select the pressure band, pressure band 2 can be selected or released unless this is done by a RS485 interface.

The following table serves to refer to links – see also chapter *5.5.4 Timer* -:

Optional Bus	Contact	Standard Bus	Timer	Pressure Range
not available or master (address = 0)	not used	master (address = 0) or band 2 was never selected after last power cut-off => no influence	not used	1
RS485 module installed as slave (address >= 1) bit 3 = 0 switches to band 1 bit 3 = 1 switches to band 2	no influence	visualization (address >= 1) no influence	no influence	according to optional bus
not available or master (address = 0)	closed	master (address = 0) or band 2 was never selected after last power cut-off => no influence	not used or band 2	2
not available or master (address = 0)	reopened	no influence	no influence	1
not available or master (address = 0)	not used	slave (address >= 1) bit 3 = 0 switches to band 1 bit 3 = 1 switches to band 2	not used	according to standard bus
not available or master (address = 0)	closed or not used	slave (address >= 1) switches to band 2 (Bit 3 = 1)	no influence	2
not available or master (address = 0)	indifferent	slave (address >= 1) switches back to band 1 (bit 3 switches from 1 to 0)	no influence	1
not available or master (address = 0)	indifferent	master (address = 0) or band 2 was never selected after last power cut-off => no influence	band 1	1
not available or master (address = 0)	closed or not used	master (address = 0) or and 2 was never selected after last power cut-off => no influence	band 2	2

6.6 Parameterization of frequency converter

If an upstream contactor is to be activated during motor standstill for parameterization of a frequency converter, actuate ↵ key for approximately 2 seconds in **Off** status of compressor (only in conjunction with main display). A possibly installed converter supply contactor is operated whereas both the motor and the green LED remain switched off.
This status is illustrated by **FC parameters** in the status display.

By actuating the O - key the converter supply contactor drops out.

When the I - key is pressed, the compressor can start.

6.7 TAN test

If the ▲-key is pressed for three seconds during the display of the version display you get to the display **TAN-Test**.

A test is selected by means of the ▼▲**-** keys and by actuating the ↵ -key. The **TAN-Test** can be left by pressing `**back**` or by actuating the i -key**.**

The **TAN-Test** offers a selection of three tests

Screen: The screen becomes dark and is continuously set up again by means of dark vertical stripes, so that all pixels are activated and deactivated. Leave the **Screen-Test** by pressing the i -key.

Keys: A display is shown where all keys of the TAN are displayed. If a key is actuated it gets a dark background. After all keys have been pressed the display goes back to the selection display.
In case one of the keys is defective a count down of 30 seconds is started. When this time is elapsed he display changes automatically back to the selection display.

LED: If this option is chosen the LEDs are activated and deactivated in a variable sequence. As an additional control the symbols of the three LEDs are displayed and shown with a black background when activated, so that it is clear which off the LEDs should be illuminated. Leave the **LED-Test** by pressing the i -key.

6.8 Basic load change with additional compressors

The control system comprises a master control function for a total of up to four compressors. This means that maximally three additional suitable compressor controls can be connected via both the integrated or optional RS485 serial interface (Modbus RTU) or optional relay modules (one relay module per compressor) to the FOCUS control which is parameterized to act as master control.

The serial connection is exclusively suited for compressors with FOCUS or RATIO controls.
The relay modules are suited for machines with BASIC control as well as all other BOGE compressor controls or controls with single pole control pressure switch using two terminals only.
As regards any other compressor makes (e.g. with electronic controls) BOGE does not assume any liability for proper connection which, besides, can be extremely expensive.

The serial RS485 connection should not be wired in star but is to be continued from compressor to compressor.

All relay modules are to be integrated in the master compressor – check for sufficient space in switch cabinet if need be.

A FOCUS control is turned into a master control by setting its parameter 70 (number of compressors) at a value above 1. This means that on all other (slave) compressors with FOCUS control(s) this number is to be set at 1.

6.8.1 **Addresses and output releases**

The addresses and output releases of compressors with serial connection (Modbus RTU) or relay modules are to be set in accordance with the following table:

Compressor N°.	Address	Relay Module Rotary Switch	Output Release
1 (Master)	0	n/a	Internal*
2	2	2	External
3	3	3	External
4	4	4	External

**) In case of switch-off or reduction (on pressure range 2) by means of integrated real time clock* see *Unscheduled air requirement.*

The basic load switch control of FOCUS can either be operated cyclically or by means of an integrated real time clock – see also chapter *5.5.4 Timer*.

In case of cyclic operation the cycle time is to be set under parameter N° 71.
The timer clock must either not be used (no channel contains a weekday) or, when used otherwise, no priority sequence may be contained in the respective timer clock channel (including series 0000, however **only ----**)!

When using the timer clock for base load switch purposes parameter 71 is to be set at zero.
In total, 26 timer clock channels (switching points) are available.
A channel is activated as soon as a weekday is entered. Any priority sequence can be freely selected. In addition, switch-off is enabled by selecting priority sequence 0000.

Selection of the second pressure range by means of timer clock enables temporarily switching to a lower pressure range.

In addition, a potential free changer of the timer clock is available.

It equally possible to run frequency controlled compressors, which are equipped with a FOCUS control unit, in base load switch operation.
Such type of operation requires Modbus RTU communication.
The compressor is run at highest priority (base load) control whereas the remainder is run in uncontrolled mode (at max. speed).

The base load switch control ordinarily uses the pressure value of parameter 12 as the upper switch-off pressure and 13 as the lower switch-on pressure (pressure range 1). All additionally required switch-off and switch-on pressure values are automatically calculated on this basis.
The own internal pressure switching points of the connected compressors are to be selected such as to avoid that these compressors do not switch off themselves within the pressure range preset in the master control. Pressure conduction losses are also to be taken into account.

If pressure reduction (parameter 14 is the upper pressure target value, whereas parameter 15 is the lower pressure target value) is used, all FOCUS controls which are connected to the master control by means of RS485 interface, are automatically switched to their second pressure range. This proves to be particularly advantageous for frequency controlled compressors because their rated target pressure is reduced at the same time and enabling them to be operated in controlled mode in pressure range 2. The digital input ‚pressure range' of the slave compressors may not be used and their timer clocks may not have any effect on their pressure range:

The control target pressure is set relative to the current upper pressure target value in parameter 016 in signed format, which means:

Control pressure target value = current upper pressure target value + parameter 16

6.8.2 **Example for monitoring and emergency operation function**

Four compressors (10 bar) all of which are equipped with a FOCUS control and a frequency converter, were connected by means of RS485 interfaces. User is to ensure that a minimum of **pressure is left** which, however, must be able to be reduced. Providing sufficient reservoir / network volume, the pressure values can be set according to the table below. The table allows a pressure reduction by 1.5 bar which can be actuated in the master control by an external contact or timer clock – as regards timer clock actuated reduction please see also chapter *Unscheduled air requirement*.

Compressor	P012 … P016 [bar]						Control Target Pressure [bar]	
Nr.	P012	P013	P014	P015	P016	P064	Press. range 1	Press. range 2
1 (Master)	9.5	7.5	8.0	6.0	-0.8	0	8.7	7.2
2	9.8	7.2	8.3	5.7	-1.1	1	8.7	7.2
3	9.9	7.3	8.4	5.8	-1.2	1	8.7	7.2
4	10.0	7.4	8.5	5.9	-1.3	1	8.7	7.2

Parameter P016 is in all events to be set such that the control target pressure values of the frequency converters are the same for all compressors.

6.8.3 **Example for no monitoring or emergency operation function**

Four compressors (10 bar) all of which are equipped with a FOCUS control and a frequency converter, were connected by means of RS485 interfaces. User requires that the pressure is to be completely released at weekends and overnight and that, in addition, it must be able to be reduced. Providing sufficient reservoir / network volume, the pressure values can be set according to the table below. The table allows a pressure reduction by 1.5 bar which can be actuated in the master control by an external contact or timer clock – as regards timer clock actuated reduction see also *Unscheduled air requirement*.

Compressor	P012 … P016 [bar]						Control Target Pressure [bar]	
Nr.	P012	P013	P014	P015	P016	P064	Press. range 1	Press. range 2
1 (Master)	9.5	7.5	8.0	6.0	-0.8	0	8.7	7.2
2	9.8	8.7	8.3	7.2	-1.1	0	8.7	7.2
3	9.9	8.8	8.4	7.3	-1.2	0	8.7	7.2
4	10.0	8.9	8.5	7.4	-1.3	0	8.7	7.2

Parameter 16 is in all events to be set such that the control target pressure values of the frequency converters are the same for all compressors.

6.9 Watching input states

If the code **00356** is entered a display opens in which the various digital inputs of the control are shown as small boxes. For an easier identification the corresponding terminal numbers of the base module are shown below.

The inputs with the closed contacts are shown with a tick inside the small box. Boxes without tick thus represent opened contacts.

Quit display by pressing the  -key.

6.10 Collection of Leakage Values

Depending on certain conditions, as are described separately, offers the following two alternatives:

a) If, during the *Leakage* display, the  key is pressed for two seconds, the number displayed in the ‚LE' field will start flashing. Repeated actuation of the  key for another two seconds will initiate a six hour delayed measurement.
Such measurement will then serve to collect within another six hours the proportionate load operation portion.

This serves as a basis for computing the displayed annual free air delivery (FAD) time portion. With view to speed controlled compressors, the compressor load (relative speed) is being taken into consideration. Thus, the displayed valued is at any rate to be multiplied by the maximum compressor output.

If, during measuring, a **power failure** takes place the number ‚**9999**', which appeared immediately

after actuation of the ↵ key, changes into ‚**9980**'.

If, during the six-hour measurement period, the compressor is put out of operation (green LEDs go out) the number ‚9999' changes into ‚**9990**'.

If the measurement is not interrupted the annual FAD time portion [h/a] will appear in the ‚LE' field and be **maintained** even after power failures or shutdowns until the next measurement is triggered.

b) The number displayed in the ‚Lc' / ‚LC' field will start flashing after actuation of the ‚LE' field.

Flashing can simply be stopped either by pressing the  key or the  key with the following effect:
The display field changes into ‚Lc 9999 h/a' while the control starts measuring the respective load operation time in six-hour intervals. After six hours of operational readiness (green LEDs are lit) the first calculated annual value as described under a) will appear. If, however, a lower load operation portion is determined, the thus computed annual value will immediately be displayed.
After a one-week operational readiness the minuscule c changes into the capital **C**. The search for the lowest value will be re-launched – on the background – once a week so that after every subsequent week a respectively higher value may be displayed if the measured minimum value has increased during that period.

While the numbers are flashing the ▼▲ keys can be used to switch between the ‚LE' and ‚LC' / ‚Lc' fields, whereas flashing can be terminated by simply pressing the  key.

7 Warning message / Fault message

As far as pending messages are concerned there is a difference between warning and fault messages.
Depending whether an input is defined as fault or warning either only the warning is displayed ort he compressor is switched off at once via a fault message.
All warning and fault messages are saved by the control in the LogBook together with operating states and time.

If a message is available at switch-on of the control tension, this is immediately being displayed by a blinking LED.

In such a case, the boot screen can be exited by means of the O key or the main menu can be accessed by using the display and acknowledging the message.

When exiting the boot screen display via the message display, the O key still needs to be actuated prior to enabling the control to return to its normal function.

7.1 Warning message

In case of a pending warning or servicing message the compressor remains in operation and this status is visible by means of a yellow coloured blinking LED on the control.

On actuation of the i key, the type of message and number are being displayed while the message can be decoded by means of the message code list.

The warning can only be acknowledged/pre-acknowledged in this display by way of the ↵ key causing the main display to appear.

Else wise repeated actuation of the i key causes the compressor status to be displayed at the time of the triggering of the first unacknowledged (displayed) warning. Further actuation of the i key causes – even from other displays (such as the main display) – return to the previous message display.

This message display can also be exited by actuating the ◄ ► buttons without acknowledging effect – for return to the main display.

If a message remains unattended for a protracted period during which several other messages were able to accumulate, the next message will not be displayed unless the cause for the currently visible message is removed.

7.2 Pre-acknowledgement

If a message is acknowledges and the reason for it is not (yet) eliminated, the corresponding LED remains continuously illuminated.
As long as a fault or warning is signalled by the LED, the fault message can be displayed again by pressing the i -key.

7.3 Fault messages

In case of a fault message the compressor is switched off at once - without idling phase.

A red blinking LED signals a pending fault message and the display shows the corresponding message type and number at once.

This fault message can only be acknowledged/pre-acknowledged in this display by way of the ↵ key causing the main display to appear.

Else wise repeated actuation of the  key causes the compressor status to displayed at the time of the triggering of the fault. Further actuation of the  key causes – even from other displays (such as the main display) – return to the previous message display.

This message display can also be exited by actuating the ◄ ► buttons without acknowledging effect – for return to the main display.

The red LED is continuously illuminated after the pre-acknowledgement of the fault and the compressor status display shows Fault until the fault has been rectified. Only then the compressor can be started again.

8 Data of external connections

8.1 Base module

Terminals	Type of terminal	Function	Description	Rating
½	Spring terminal	Relay output	Ready for operation: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
3/4/5	Spring terminal	Relay output	Faultless: Group. terminal 3, break contact terminal 4 and make contact Terminal 5	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
6/7	Spring terminal	Relay output	Operation: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
8/9	Spring terminal	Relay output	Load operation: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
10/11	Spring terminal	Relay output	Service: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
12/13	Spring terminal	Relay output	Pre-selection remote: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
14/15	Spring terminal	Relay output	Timer: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
34	Spring terminal	Digital input	Monitoring Compressed air treatment Terminal 34 (against Terminal 31(+24V)	24...31V DC, 10mA, Input resistance 3KΩ
40	Spring terminal	Digital input	Output release Terminal 40 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
41	Spring terminal	Digital input	Remote Start/stop switch Terminal 41 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
42	Spring terminal	Digital input	Pressure range selection Terminal 42 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
51	Screw terminal	External RS485 interface	Earth (GND)	
52	Screw terminal	External RS485 interface	Signal A	Input voltage diff. max. +12V
53	Screw terminal	External RS485 interface	Signal B	Input voltage diff. max. -12V

8.2 Analogue output module

Terminals	Type of terminal	Function	Description	Rating
1/2	Spring terminal	Analogue output	Act. frequency value: 4-20mA (Terminal 1) against Terminal 2 (GND)	Max. 28mA, max. load 400Ω

8.3 RS 485-Module

Terminals	Type of terminal	Function	Description	Rating
1	Spring terminal	External RS485 interface	Earth (GND)	
2	Spring terminal	External RS485 interface	Signal A	Input voltage diff. max. +12V
3	Spring terminal	External RS485 interface	Signal B	Input voltage diff. max. -12V

8.4 Cable cross-sections

For the external connections the following conductor cross sections can be used:

8.4.1 **Screw terminals**

Solid / flexible min	0.2 mm²
Solid / flexible max	2.5 mm²
Flexibel mit Aderendhülse (mit/ohne Kunststoffhülse) min	0.25 mm²
Flexibel mit Aderendhülse (mit/ohne Kunststoffhülse) max	2.5 mm²
Flexible with ferrule (with/without plastic collar) min	24
Flexible with ferrule (with/without plastic collar) ma	12
AWG/kcmil min	0.2 mm²
AWG/kcmil max	1 mm²
2 conductors with same cross section, solid min	0.2 mm²
2 conductors with same cross section, solid max	1.5 mm²
2 conductors with same cross section, flexible min	0.25 mm²
2 conductors with same cross section, flexible max	1 mm²
2 conductors with same cross section, flexible with ferrule w/o plastic collar	0.5 mm²
2 conductors with same cross section, flexible with ferrule w/o plastic collar	1.5 mm²

8.4.2 **Spring terminals**

Capacity of terminals	0.5...1.5 mm²
Single wire	0.5...1.5 mm²
Stranded wire	0.5...1.5 mm²
With ferrule	0.5...1.5 mm²
AWG conductor	26-14

9 Table of messages

Number	Meaning	Compressor switch-off
1	Final compression temperature too high (>110C°)	X
2	Motor temperature too high	X
3	Fan motor	X
4	Wrong rotational direction	X
5	Compressor system pressure too high	X
6	Suction filter differential pressure too high	
7	Oil filter differential pressure too high	Parameterizable via P044
8	Oil separator differential pressure too high	
9	No output	[1]
10	Motor servicing due	
11	Compressor servicing due	
12	System pressure decrease too slow	
13	Frequency converter signals fault (no release)	X
14	Temperature too low (<3°C)	X
15	Suction regulation / Proportional control	
16	Net pressure transmitter faulty	X
17	Pressure build-up too fast/ increase too sharp	X
18	Fault of an external control	
19	Power-up phases too short, too many motor switching cycles	
20	Continuous contact of an external control	
21	Receiver servicing due	
25	Data reconciliation error	1st warning then fault
26	Control unit OFF-key does not open	X
27	Control unit ON-key does not open	X
28	Control unit INFO-key does not open	
29	Control unit ENTER-key does not open	X
30	Control unit UP-key does not open	
31	Control unit DOWN-key does not open	
32	Net pressure transmitter wire breakage	X
33	Compressor system pressure transmitter wire breakage	X
34	Compressor system pressure transmitter faulty	X
36	Bus live bit faulty	
38	Excess current compressor motor	X
39	Fault compressed air processing	Parameterizable via P061
40	FC-(frequency converter) module error	X
41	Battery voltage too low	
42	FC-(frequency converter) module not calibrated	X
43	FC-(frequency converter) module overflow	
44	FC-(frequency converter) module underflow	
45	Watchdog timer Reset, acknowledging need interrupt of (control) voltage	
46	Watchdog not active	
47	not assigned, previously: f-timer or. f-CPU not clear (cycle frequency)	
48	TAN identifies internal BUS fault	X
49	TAN misses data (from base module)	X
50	Dryer module Fault	Parameterizable via P061
51	Pressure transmitter faulty at dryer	Parameterizable via P061
52	Cooling temperature sensor - Fault	Parameterizable via P061
53	Ambient temperature sensor faulty	Parameterizable via P061
54	Pressure at dryer too high (coolant)	Parameterizable via P061
55	Pressure dew point dryer too low	Parameterizable via P061
56	Pressure dew point dryer too high	
57	Temperature compressed air outlet	Parameterizable
58	Control unit LEFT-key does not open	
59	Control unit RIGHT-key does not open	
60	Base module recognizes TAN error	X
61	Communication to RS485 module faulty	
62	Communication to catalyst module faulty	X
63	Communication to analogue output module faulty	
64	Motor bearing-Excessive temperature	X
71	not assigned, previously: running time memory 1	

[1] Sondersoftware (3) für Krankenhaus: Erst Warnung, dann Abschaltung

Number	Meaning	Compressor switch-off
72	not assigned, previously: running time memory 2	
73	Parameter type	
74	Dryer and compressor service due	
75	Software-Version does not correspond to TAN	
97	Only with LVM: Side duct fan overcurrent	X

10 Parameter overview

Parameter No:	Meaning:	Adjustment range:	Code level:
P001	Language selection	see *P001 Language*	alle
P012	Max. pressure for pressure range 1	0bar, 4bar - max. pressure of compressor type	User
P013	Min. pressure for pressure range 1	3bar – max. P012 less min. hysteresis	User
P014	Max. pressure for pressure range 2	0bar, 4bar - max. pressure of compressor type	User
P015	Min. pressure for pressure range 2	3bar – maxi. P014 less min. hysteresis	User
P016	Delta P (FC – frequency converter)		User
P020	Auto restart (Automatic restart after power failure)	0 = Off; 1 = On	User
P021	Auto restart time; time until restart after power failure	30s- 3600s	User
P022	Short stop limiting value	0-3600s	User
P031	After-running time	0s -600s	User
P032	Anti-freeze protection; Compressor starts when final compression temperature drops below 5°C and switches off as soon as 20°C are reached	0 = On; 1 = Off	User
P034	Continuous operation; Compressor does not switch off but stays continuously in idling operation.	1 = On, 0 = Off	User
P042	Booster pressure	0 bar - 12bar	User
P044	Type of message oil filter	1:Fault, 0:Warning	User
P050	Modbus address	0 for master, 2-4 for additional compressors, 1-248 for other applications	User
P051	Modbus baud rate	1200-115200	User
P052	Modbus communication parameter	8Even1, 8None1, 8None2, 8Even2, 8Odd1 und 8Odd2	User
P053	Modbus address (module)	0 for master, 2-4 for additional compressors, 1-248 for control applications (only)	User
P054	Modbus baud rate (module)	1200-115200	User
P055	Modbus communication parameter (module)	8Even1, 8None1, 8None2, 8Even2, 8Odd1 and 8Odd2	User
P060	Type of contact compressed air treatment	0:Break contact, 1:Make contact	User
P061	Type of message compressed air treatment	1:Fault, 0:Warning	User
P063	External output release	0...2	User
P064	Monitoring external output release	0...1	User
P065	Remote - Start/Stop	0...3	User
P066	Max. pressure for pressure range 1	0bar, 4bar - max. pressure of compressor type	User
P070	Number of compressors	1…4	User
P071	Interval time Base Load Switching	0…250h	User

Parameters can be processed as described in chapter 5.3 “Set Parameters”.

11 Service

11.1 Used symbols

Vorsicht Verletzungsgefahr!
Dieses Symbol warnt vor Gefahren für Leben und Gesundheit des Bedieners oder anderer Personen.

Caution! Risk of injury!
This symbol indicates information warning of possible danger to the life and limb of the operator and other people.

ACHTUNG!
Dieses Symbol warnt vor Gefahren, die die Zerstörung oder Beschädigung des Kompressors verursachen können.

Attention!
This symbol indicates information warning of possible hazards which might damage or destroy the compressor.

11.2 Bus connections with ribbon cable connector

In order to avoid any damages to the control, make sure that any **insertion or removal** of ribbon cable connectors on the module of the control be made in **potential free** condition!

11.3 FLASHing

During the FLASHING procedure an **uncontrolled clocking of the relay** is possible. Therefore it must be guaranteed that the contactor coils and other motor control appliances (FC) are de-energized- e.g. **actuation of the Emergency-Stop-button** resp. **pulling of the plug "21...25"**
In addition, the following is to be taken into account at **grounded** alternating voltage at terminals **A1 and A2**:
The **PC** which is to be FLASHED must either **not** be connected to a socket – **grounded** – or the (green-yellow) protective conductor connection at the power transformer of the FOCUS control is to (temporarily!) opened for FLASHING by removing the respective cable lug. Otherwise **damage** may be caused to any other involved electronic equipment!

11.3.1 **Recovery of operating times after change of base module**

Bei einem Wechsel in die Betriebszustände **Aus**, **Not-Halt**, **Störung** oder **Ausgangstest** sowie When changing to the operating modes **Off, Emergency-Stop, Fault or Output test** or after an **elapse time of 11 h** the current operating times are communicated to the TAN.

After each voltage recovery it is checked whether the operating time values of the TAN are higher than those on the base module. Thus it can be recognised whether a module change was carried through and a window with the headline **‚Operating hours recovery?'** can be shown, if applicable.

By actuating the ▼▲-keys you can choose between **Yes** and **No** and by means of the  -key the selection can be acknowledged.

If **YES** is selected the data a communicated from the TAN to the base module.

If **NO** is selected the data of the base module are accepted by the TAN.

11.4 Modules

For all Focus modules the following environmental conditions are specified:

Temperature ranges:

- Storage: -15 … +70 °C
- Operation: 0 … +45 °C

Protection:

- IP 00

Humidity:
- 5 … 90 %, no dewing

During operation the compliance with these general conditions have to be ensured, if necessary by cooling or heating the switch cabinet.

The voltage cut-off is realised by means of the power disconnecting device of the compressor.

The modules do not require any special protection.
The energy consumption of all installed modules may not exceed the max. available performance capacity; otherwise a thermistor in the base module serves to internally cut out voltage supply.
The approved conductor cross-sections of the terminals can be looked up in chapter 8.4 *Cable cross-sections*.

11.4.1 **Base module**

The base module is equipped with :

- 11 relay outputs
- 4 analogue inputs
- 10 digital inputs
- 1 external RS485 interface

the supply input

Terminals A1 and A2 for
24V +/-10% 50/60Hz 15W or
24V DC +/-10% 0,4A

the battery
The FOCUS real-time-clock is powered by a built-in, replaceable 3 V battery – provided the plug-in jumper contacts arranged next to it are connected – in case of power failures.

internal serial interfaces

ISP-plug (plug connector - 2x3 poles; on the left of RS485-plug of same type) on p.c.b. for loading of programs and parameters with special adaptors and special loading software.

Internal RS458 interface (plug connector - 2x3 poles; directly at the edge of p.c.b.) for connection of additional modules and via RJ12 plug for connection to TAN

Technical data base module terminals

Terminals	Type of terminal	Function	Description	Rating
1/2	Spring terminal	Relay output	Ready for operation: Make contact Terminal	2A 30V DC/250 V AC at ohmic load; 0.6A 250 V AC 50/60Hz at inductive load (power factor = 0.4)
3/4/5	Spring terminal	Relay output	Faultless: Group. terminal 3, break contact terminal 4 and Make contact Terminal 5	2A 30V DC/250 V AC at ohmic load; 0.6A 250 V AC 50/60Hz at inductive load (power factor = 0.4)
6/7	Spring terminal	Relay output	Operation: Make contact	2A 30V DC/250 V AC at ohmic load; 0.6A 250 V AC 50/60Hz at inductive load (power factor = 0.4)
8/9	Spring terminal	Relay output	Load run: Make contact	2A 30V DC/250 V AC at ohmic load; 0.6A 250 V AC 50/60Hz at inductive load (power factor = 0.4)
10/11	Spring terminal	Relay output	Service: Make contact	2A 30V DC/250 V AC at ohmic load; 0.6A 250 V AC 50/60Hz at inductive load (power factor = 0.4)

Terminals	Type of terminal	Function	Description	Rating
12/13	Spring terminal	Relay output	Remote pre-selection: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
14/15	Spring terminal	Relay output	Timer: Make contact	2A 30V DC/250 V AC at ohmic load; 0,6A 250 V AC 50/60Hz at inductive load (Power factor = 0,4)
34	Spring terminal	Digital input	Monitoring compressed air treatment Terminal 34 (against Terminal 31(+24V)	24...31V DC, 10mA, Input resistance 3KΩ
40	Spring terminal	Digital input	Output release Terminal 40 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
41	Spring terminal	Digital input	Remote Start/stop switch Terminal 41 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
42	Spring terminal	Digital input	Pressure range selection Terminal 42 (against Terminal 31(+24V))	24...31V DC, 10mA, Input resistance 3KΩ
51	Screw terminal	External RS485 interface	Earth (GND)	
52	Screw terminal	External RS485 interface	Signal A	Input voltage diff. max. +12V
53	Screw terminal	External RS485 interface	Signal B	Input voltage diff. max. -12V

Terminals 51, 52 and 53 of the FOCUS correspond to terminals 5.1, 5.2 and 5.3 of the RATIO.

Terminals FOCUS base module	Terminals FOCUS RS485 module	Terminals RATIO
51	1	5.1
52	2	5.2
53	3	5.3

11.4.2 **Operating unit (TAN)**

The TAN comprises a backlit 128x64 Pixel display, three LEDs – green, yellow and red and the following eight keys: O | ◄ ► ▼ ▲ i ↵.

On the backside of the TAN the following **plugs** are located:

RJ12 plug for power supply and communication (internal RS485) with the base module.

ISP-plug (plug connector - 2x3 poles) on p.c.b. for loading of programs with special adaptors and special loading software.

11.4.3 **Dryer module**

If applicable, the dryer module is installed as an additional module into the switch cabinet of the integrated dryer and is, because it is only fitted with one corresponding Bus connection, connected as the last module in the sequence of modules.

Controller function

Basically a two-position controller with the cooling temperature as controlled variable is used fort he energy saving regulation.
The switch on/off values are fixed values allowing a dew point of 3°C and preventing a freezing of the dryer.
As the dryer control knows the current compressor status it can be considered as far as the control is concerned. Therefore the dryer status is linked to the compressor status.

Only for factory assembly and servicing:

Compressor status	Dryer status
Off/Emergency-Off	Off
Run-up phase	Temperature regulation 3°C
Load operation	Temperature regulation 3°C
Idling	Temperature regulation 3°C
Ready	Temperature regulation StandBy
Fault	Off

Temperature regulation 3°C:
If the dryer runs in load operation, the above described on/off control is active.
Since refrigerant dryer only has a limited number of switching operations, a fixed min. operation time of 4 minutes is defined. After starting the refrigerant dryer thus operates at least for the defined min. operation time and does therefore not switch more than 15 times per hour.
If the lower limit value of the cooling temperature is reached within this period, the dryer switches to the idling status, allowing the bypass solenoid to open.

Temperature Regulation Standby:
With view to the compressor status Ready there is an equivalent for the dryer status, too, in which the cooling temperature is kept low during intermittent operation in order to ensure a fair pressure dew point when compressed air is required. The dryer immediately shuts off when reaching the lower limit value and switches to load operation when exceeding the upper limit value, however not before expiry of 4 minutes after its last start. This avoids actuation of the bypass solenoid.
The upper limit value is linked to the ambient temperature and is calculated as follows:

upper limit value for standby = ambient temperature – 10K
(5°C ≤ upper limit value for standby ≤ 18°C)

Monitoring functions

All massages leading to a standstill of the dryer can be parameterized under P061as a warning or as a fault.

Dew point monitoring

If the measured cooling temperature exceeds the maximum value a warning message is displayed, delayed by a one-minute interval.
After switch-on of the control this message is delayed once by 5 minutes. When dropping below the minimum value a warning message delayed by one minute is displayed too.

Hardware monitoring

The sensors are monitored for wire breakage. In case of a defect a warning resp. fault message is displayed.

Efficiency display

The efficiency of the energy saving regulation is calculated as follows:

Efficiency = 100% x (load running time x 100% / (load running time x 100% + idling time x idling output percentage))

Thus the efficiency display includes the ratio between load energy and total energy.

Connections

The following contacts are available on the dryer module:

3 relay contacts
3 analogue inputs
1 digital input (not used at the moment)
ISP-plug (plug connector - 2x3 poles) on p.c.b. for loading of programs and parameters with special adaptors and special loading software
Internal RS485 interface for the communication of the FOCUS modules with each other

Technical data of the dryer module terminals

Terminals	Type of terminal	Function	Description	Rating
1/2	Spring terminal	Relay output	Relay 1: Make contact Terminal 2 (Potential Terminal 1)	1A 30V DC/250 V AC at ohmic load, 250V AC 150W (Power factor = 0,6), primary wiring
1/3	Spring terminal	Relay output	Relay 2: Make contact Terminal 3 (Potential Terminal 1)	1A 30V DC/250 V AC at ohmic load, 250V AC 150W (Power factor = 0,6), primary wiring
1/4	Spring terminal	Relay output	Relay 3: Make contact Terminal 4 (Potential Terminal 1)	1A 30V DC/250 V AC at ohmic load, 250V AC 150W (Power factor = 0,6), primary wiring
5/6	Spring terminal	Supply output	24V DC output Terminal 5 (against terminal 6 [GND])	24...31V DC, max.100mA
7	Spring terminal	Digital input	Reserve, Terminal 7 (against terminal 5 [+24V])	24...31V DC, 10mA, Input resistance 3kΩ
8/9	Spring terminal	Analogue input	Pressure transmitter 4-20mA Terminal 9 (+24V Terminal 8)	max. 22mA DC, Input resistance 150Ω
10/11	Spring terminal	Analogue input	NTC 2 Terminal 11 (GND Terminal 10)	
Temperature Range - 10...60°C	NTC (47753...2760Ω), max. 0.5mA	Analogue input		
12/13	Spring terminal	Analogue input	NTC 1 Terminal 13 (GND Terminal 12)	
Range - 10...20°C	NTC (47753...12271Ω) , max. 0.5mA			
14/15	Spring terminal	Supply input (RS485)	Terminal14 (GND) and Terminal 15 (+24V DC)	24...31V DC
16	Spring terminal	RS485-interface	Signal B	Input voltage diff. max. +12V
17	Spring terminal	RS485-interface	Signal A	Input voltage diff. max. -12V

11.4.4 **FC (frequency converter) module**

The following contacts are available on FC module

- 1 relay contact
- 2 analogue inputs
- 1 analogue output
- 1 digital input
- ISP plug (plug connector - 2x3 poles) on PCB for loading of programmes and parameters with special adapters and special loading software
- RS485-In-Plug (plug connector - 2x3 poles) for internal communication (with base module)
- RS485-Out-Plug (plug connector - 2x3 poles) for the connection of additional modules

Technical data FC module terminals

Terminals	Type of terminal	Function	Description	Rating
1/2	Spring terminal	Digital input	Converter ready:	
Terminal 2 against terminal 1 (+24V)	24...31V DC, 10mA, Input resistance 3kΩ			
3/4	Spring terminal	Relay output	Motor On (make contact):	

Terminals	Type of terminal	Function	Description	Rating
14 (Terminal 3) 13 (Terminal 4) Separated from external supply voltage by means of double insulation	max. 30V DC/AC. 2A,			
5/8 0-10V (Terminal 5) against terminal 8 (GND)) Separated from external supply voltage by means of double insulation	Spring terminal max. 11V DC, Input resistance 57kΩ	Analogue input	Actual frequency :	
6/7 4-20mA (Terminal 7) (+24V Terminal 6) Separated from external supply voltage by means of double insulation	Spring terminal max. 22mA DC, Input resistance 150Ω	Analogue input	Actual frequency:	
9/10 0-10V (Terminal 9) against terminal 10 (GND)	Spring terminal max. Ausgabe 12V DC, Last > 2,5kΩ	Analogue input	Target pressure value:	

11.4.5 **Analogue output module**

On the analogue module an analogue output is located for the communication of the actual frequency value to the master control

as well as two internal serial interfaces:

- RS485 IN plug (plug connector - 2x3 poles), for internal communication (with base module)
- RS485 Out plug (plug connector - 2x3 poles) for connection of additional modules
- ISP-plug for FLASHING the module. (see *11.3 FLASHing*)

Technical data analogue output module terminals

Terminals	Type of terminal	Function	Description	Rating
1/2	Spring terminal	Analogue output	Act. Frequency value: 4-20mA (Terminal 1) against Terminal 2 (GND)	Max. 28mA, max. load 400Ω

11.4.6 **RS485-Module**

On this module a further RS485 interface is located for the connection of additional compressors. This module is only needed if the external RS485 interface of the base module is required for other purposes (e.g. visualization).

Furthermore two internal serial interfaces are available:

- RS485 IN plug (plug connector - 2x3 poles), for internal communication with base module
- RS485 Out plug (plug connector - 2x3 poles) for connection of additional modules
- ISP-plug for FLASHING the module. (see *11.3 FLASHing*)

Technical data RS485 module terminals

Terminals	Type of terminal	Function	Description	Rating
1	Spring terminal	External RS485 interface	Earth (GND)	
2	Spring terminal	External RS485 interface	Signal A	Input voltage diff. max. +12V
3	Spring terminal	External RS485 interface	Signal B	Input voltage diff. max. -12V

Terminals 1, 2 and 3 of the FOCUS correspond to terminals 5.1, 5.2 and 5.3 of the RATIO.

Terminals FOCUS base module	Terminals FOCUS RS485 modules	Terminals RATIO
51	1	5.1
52	2	5.2
53	3	5.3

11.4.7 **Relay module**

The module is equipped with a relay including a potential free changer.
Rotary switch (0 … F) serves to select the required function.

Available functions:

Rotary switch position	**Function**
0	
1	
2	Compr. control for compressor no.2
3	Compr. control for compressor no.3
4	Compr. control for compressor no.4
5	
6	
7	
8	
9	
A	Message , Ready fro operation' (On)
B	Message , Fault' (inverted)
C	Message ‚Operation' (Motor is running)
D	Message , Load operation' (output)
E	Message , Service due'
F	Message Dryer message is active

A relay module is controlled by the FOCUS control without feedback. Therefore it does not appear on any software version display, with every relay module function principally qualifying for multiple installation.

Terminals	**Type of terminal**	**Function**	**Description**	**Rating**
1/2/3	Spring terminal	Relay output	Function selectable (changeover contact): 11 Root (Terminal 1) 14 Break contact (Terminal 2) 12 Make contact (Terminal 3)	max. 30V DC/AC. 2A

Two internal serial interfaces are available:

- RS485 IN plug (plug connector - 2x3 poles), for communication with base module
- RS485 Out plug (plug connector - 2x3 poles) for connection of additional modules
- ISP-plug for FLASHING the module (see *11.3 FLASHing*)

11.4.8 **Projected modules**

with two digital inputs
with a 0/4-20mA or a 0-10V input
for two PT100 resistance thermometers

11.5 Service parameters

The following parameters must not be set by the customer.

11.5.1 **P010 Measuring range sensor**

The measuring range for the pressure sensors can be set here (6bar -100bar). Both pressure sensors must have the same measuring range! If applicable the measuring range has to be considered for the parameterization of the frequency converter pressure target input!

11.5.2 **P011 Minimum hysteresis**

With this parameter the minimum hysteresis between switch-on pressure (P_{min}) and switch-off pressure (P_{max}) of the two pressure ranges is set.
The new setting of the hysteresis only becomes active when P_{max} or P_{min} are set or changed too.

☝ **When setting the upper and lower pressure target value (P_{min} and P_{max}) the values are automatically kept at a distance given by the minimum hysteresis.**

11.5.3 **P030 Run-up time**

Represents the load delay time and is – where applicable – identical with the star phase time. The run-up time depends on the maximum number of motor starts.

Motor power [kW]	**2.2-7.5**	**11-22**	**30-55**	**65-90**	**110-160**	**200-250**	**>250**
Maximum permissible motor starts per h	30	25	20	15	10	5	< 5
Run-up time [s]	6	8	10	12	15	20	30

11.5.4 **P033 Number of motor starts**

Under this parameter the permissible number of motor switch cycles per hour is entered.

Motor power [kW]	**2.2-7.5**	**11-22**	**30-55**	**65-90**	**110-160**	**200-250**	**>250**
Maximum permissible motor starts per h	30	25	20	15	10	5	< 5
Run-up time [s]	6	8	10	12	15	20	30

11.5.5 **P040 System pressure limitation**

If the system pressure exceeds the set pressure value the compressor switches off showing a corresponding fault message. The default value is 10.8 bar nominal compressor pressure.

☝ The value is to be set at 0.2 bar below the safety valve release pressure.

11.5.6 **P041 Rotational direction monitoring**

Once a value has been set above 0.0 bar the control monitors pressure increases within the run-up phase of the motor. If this pressure value is reached or exceeded on the suction side of the compressor during the run-up phase, the compressor switches off automatically via Fault. (4).

☝ For the monitoring of the rotational direction an optional double check valve is needed.

The actual pressure value prior to the start of the star phase is registered and regarded for the monitoring, so that even for booster compressors no other value must be set compared to compressors with atmospheric booster pressure of the same type.

☝ The value is set for all compressor types ≤ S15 to 1.2 bar, for all other compressors to 1.6 bar.

11.5.7 **P043 Oil separator differential pressure**

If the difference between system pressure and net pressure exceeds the set value, the control displays a warning message.

The maximum differential pressure is automatically parameterized (0.7 bar) during the loading of the control software. In special cases the differential pressure can be changed.

11.6 Grouped parameters / parameter management – Service

11.6.1 **Updating of configuration**

Enter Code 00007

2. In the displayed window you can read **Update configuration.** Select **Yes** by means of the ▼▲-keys and acknowledge by actuating the ↵-key.

Not only does the control serve to remove non-connected modules and/or non-wired inputs but it also cancels the maximum frequency registered on a FC module if need be.

11.6.2 **Save parameters**

With this function the factory-set parameters can be saved, so that they are available later on.
If the code **00977** for the saving of the parameters is entered, a window is displayed with the headline **Save settings**.
Use▼▲ –keys for the selection of either **Yes** or **No**.

If **Yes** is selected and acknowledged by actuating the ↵-key all current settings of the control parameters are saved on the TAN and can be reloaded into the control by means of the function "Restore parameters".
If No is selected this section is left without any changes.

11.6.3 **LogBook**

To get into the Logbook code **00567** must be entered.

In the Logbook the last 25 warning and fault messages are saved together with the most important system data for the time when the fault occurred.
Having entered the code the last message is displayed at once.
Recorded are: type of message, error code, date, time, operating time, compressor status, net and system pressure as well as the final compression temperature.

By means of the ◄ key a previous message can be displayed provided there was a message. By means of the ► key the message saved later on can be scanned. By repeated actuation of one of the two ◄ ► keys the complete content of the LogBook can be scrolled as desired because all saved information a forming a circle regardless of the number (max.25).

You leave the Logbook by entering the i-key.

11.6.4 **Parameter History**

If the code **47862** is entered you get to the **Parameter History.**

By means of this function all parameter changes to the control can be displayed and reproduced.

The time of the respective change (date and time) is shown together with the number of the changed parameter (see parameter overview) and the accomplished change of the setting (e.g. from 10 bar -> 8 bar).
The change implemented last is shown first. With the ◄► -keys the saved parameter changes can be browsed, whereby the ◄-key always shows the older version and the ► -key the newer ones.

If no change is saved (e.g. after a software update) a switch-over from the code input to the main display takes place.

You leave the display by actuating the [I] - key.

11.6.5 **Re-start efficiency calculation**

To restart the efficiency calculation code **00999** has to be entered.

In the displayed window you can read: **Restart efficiency calculation?**

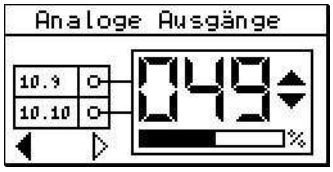
Use ▼▲-keys to select **Yes** or **No** and acknowledge by means of the [↵] - key.
If **No** is selected this section is left without any changes.
When acknowledging the selection **Yes** the existing efficiency calculation is deleted and a new calculation is started.

11.6.6 **Individual activation of outputs**

When the compressor is switched off, code **00653** will be accepted and various outputs are displayed as boxes with pertaining **bus address** of the module and its **terminal number** (its close contact).. As regards relay modules**,** either their switch position is displayed or, as regards message functions already available in the base module, the respective relay module is also stimulated during testing of the corresponding base module relays.
The cursor points to the first output and flashes. It is moved to one of the other outputs by using the arrow keys ◄ ►.

Now the input can be activated by means of the [I]-key.

The deactivation is accomplished by pressing the [O]- key, resp. by moving the cursor to another output. Scrolling is possible as long as the arrows on the side are filled. If there are any analogue outputs in the compressor (e.g. on the FC module) the following display appears if all digital outputs have been displayed after having actuated the ► key:



By means of the ▼ or▲ key the analogue output can be set, whereas 0 - 100% corresponds to output type 0…10V, resp. 4…20mA .

This section can be left by pressing the [i]-key.

11.6.7 **Forced idling**

By pressing the [↵] - key and the [I] - key at the same time a compressor delivering compressed air can be switched into Forced idling.

To finish the forced idling the compressor **has to be** switched off by means of the [O] - key.

12 Parameter table

Parameter No.	Meaning	Adjustment range	Code level
P001	Language selection	see *P001 Language*	all
P010	Measuring range of sensor	6bar - 100bar	Boge
P011	Min. hysteresis Switch-on/switch-off pressure	0bar - 5bar	Service
P012	Max. pressure for pressure range 1	0bar, 4bar – max. set P040	User
P013	Min. pressure for pressure range 1	3bar – max. P012 less P011	User
P014	Max. pressure for pressure range 2	0bar, 4bar – max. set P040	User
P015	Min. pressure for pressure range 2	3bar – max. P014 less P011	User
P016	Delta P (FC – *frequency converter*)		User
P020	Auto Restart (Automatic restart after net power failure)	0 = Off; 1 = On	User
P021	Auto Restart time; time until restart after power failure	30s - 3600s	User
P022	Short stop limiting value		User
P030	Run-up time; time in run-up phase until load run is reached	5s - 99s / for LVM 0s-99s	Service
P031	After-running time	0s - 600s	User
P032	Anti-freeze protection; Compressor starts when final compression temperature drops below 5°C, and switches off as soon as 20°C are reached	0 = On; 1 = Off	User
P033	Number of motor starts; Limitation of the number of motor starts per hour	1 - 40	Boge
P034	Continuous operation; Compressor does not switch off but stays continuously in idling operation.	1 = On, 0 = Off	User
P040	System pressure limitation; system pressure exceeds default maximum value	3 – Measuring range of the sensor (P010)	Service
P041	Monitoring of rotational direction	0 bar - 5 bar	Boge
P042	Booster pressure	0 bar - 12bar	User
P043	Differential pressure oil separator	0,7 bar -16bar	Service
P044	Type of message oil filter	1:Fault, 0:Warning	
P050	Modbus address	0 for master, 2-4 for additional compressors, 1-248 for other applications	User
P051	Modbus baud rate	1200-115200	User
P052	Modbus communication parameter	8Even1, 8None1, 8None2, 8Even2, 8Odd1 and 8Odd2	User
P053	Modbus address (module)	0 for master, 2-4 for additional compressors, 1-248 for control applications (only)	User
P054	Modbus baud rate (module)	1200-115200	User
P055	Modbus communication parameter (module)	8Even1, 8None1, 8None2, 8Even2, 8Odd1 and 8Odd2	User
P060	Contact type compressed air purification	0:Break contact, 1:Make contact	Service
P061	Type of message for compressed air purification	1:Fault, 0:Warning	User
P063	External output release	0...2	User
P064	Monitoring of external output release	0...1	User
P065	Remote Start/Stop	0...3	User
P066	Key switch	0...3	User
P070	Number of compressors	1…4	User
P071	Interval time Base Load Switching	0…250h	User
P080	Service interval Compressor		00111
P081	Service interval Motor		00111
P082	Service interval Combined receiver		00111
P083	Service interval Dryer		00111

Parameters can be processed as described in chapter 5.3 Set Parameters.

13 List of messages

Number	Meaning	Compressor switch-off
1	Final compression temperature too high (>110C°)	X
2	Motor temperature too high	X
3	Excess current fan motor	X
4	Wrong rotational direction	X
5	Compressor system pressure too high	X
6	Suction filter differential pressure too high	
7	Oil filter differential pressure too high	Parameterizable via P044
8	Oil separator differential pressure too high	
9	No output	[2]
10	Motor servicing due	
11	Compressor servicing due	
12	System pressure decrease too slow	
13	Frequency converter signals fault (no release)	X
14	Temperature too low(<3°C)	X
15	Suction regulation / Proportional control	
16	Net pressure transmitter faulty	X
17	Pressure build-up too fast/ increase too sharp	X
18	Fault of an external control	
19	Power-up phases too short, too many motor switching cycles	
20	Continuous contact of an external control	
21	Receiver servicing due	
25	Data reconciliation error	1st warning then fault
26	Control unit OFF key does not open	X
27	Control unit ON key does not open	X
28	Control unit INFO key does not open	
29	Control unit ENTER key does not open	X
30	Control unit UP key does not open	
31	Control unit DOWN key does not open	
32	Net pressure transmitter wire breakage	X
33	Compressor system pressure transmitter wire breakage	X
34	Compressor system pressure transmitter faulty	X
36	Bus live bit faulty	
38	Excess current compressor motor	X
39	Fault compressed air processing	Parameterizable via P061
40	FC-(*frequency converter*) module fault	X
41	Battery voltage too low	
42	FC-(*frequency converter*) module not calibrated	X
43	FC-(*frequency converter*) module overflow	
44	FC-(*frequency converter*) module underflow	
45	Watchdog timer Reset, acknowledging need interrupt of (control) voltage	
46	Watchdog not active	
47	not assigned, previously: f-clock resp. f-CPU discrepant (clock frequency)	X
48	TAN identifies internal BUS fault	X
49	TAN misses data (from base module)	X
50	Dryer module - Fault	Parameterizable via P061
51	Pressure transmitter faulty at dryer	Parameterizable via P061
52	Cooling temperature sensor - Fault	Parameterizable via P061
53	Ambient temperature sensor faulty	Parameterizable via P061
54	Pressure at dryer too high (coolant)	Parameterizable via P061
55	Pressure dew point dryer too low	Parameterizable via P061
56	Pressure dew point dryer too high	
58	Control unit LEFT-key does not open	
59	Control unit RIGHT-key does not open	
60	Base module recognizes TAN fault	X
61	Communication with RS485 module faulty	
62	Communication with catalyst module faulty	X
63	Communication with Analogue output module faulty	
64	Excessive motor bearing temperature	X
71	not assigned, previously: running time memory 1	

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Number	Meaning	Compressor switch-off
72	not assigned, previously: running time memory 2	
73	Parameter type	
74	Dryer and compressor service due	
75	Only for LVM: side duct fan overcurrent	
97	not assigned, previously: running time memory 1	X

14 Parameter-Code Table

CODE	Meaning
17391	User code / parameter list
15963	Service code / parameter list
	Boge code / parameter list
00000	Parameter view/ access previous code
00111	Setting/resetting of servicing interval
00653	Individual activation of outputs
00356	Viewing of input states
00977	Save parameters
00988	Restoring of parameters
00567	Logbook
00798	Timer settings
00007	New registration of connected components
00999	Resetting of efficiency display/ start new calculation
47862	Parameter History