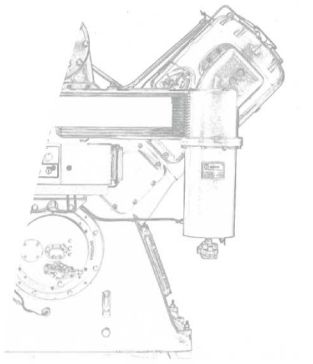
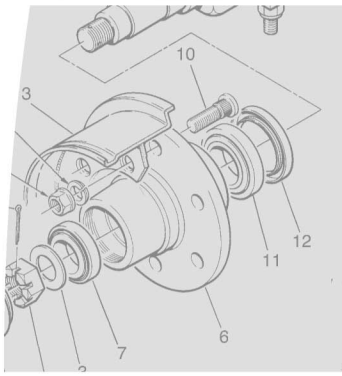
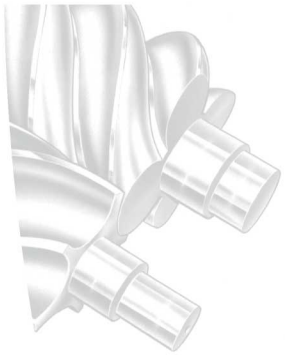
CompAir

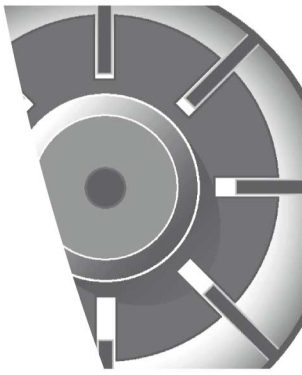






Translation of the original operating instructions

Compressor controller DELCOS XL / L series



GB ZS1068336 / 03 - February 2016

CONTENTS

1 FOREWORD

1.1 About these operating instructions

These operating instructions contain information about controllers for fixed speed or variable speed compressors and water- or air-cooled compressors.

Special sections are labelled accordingly:

- (**FS**) (fixed speed); for fixed speed compressors
- (**RS**) (regulated speed); for variable speed compressors
- (**A**) (air); for air-cooled compressors
- **(ARV)** (air regulated ventilator); for compressors with air-cooling and speed-controlled fan blower (oil cooling)
- (**W**) (water); for water-cooled compressors

All the inputs shown (parameters, settings and configurations) are examples and do not apply to a special application. They are not specific values for your particular model of compressor.

The controller DELCOS XL is exclusively intended for use with series L compressors from Gardner Denver.

These operating instructions are valid for the controller DELCOS XLfrom software version DXL-L(RS)-2.3x.

Personnel Requirements

Only appointed personnel may work on the controller and the compressor. The personnel have been trained and briefed about the compressor.

The responsibilities of the personnel for operation, maintenance and repair must be clearly defined.

The safe and hazard-aware working of the personnel must be checked regularly.

Personnel who are to be trained in, taught about or instructed as part of a general training course, must only work on the controller and compressor under the constant supervision of an authorised person.

If safety-relevant changes are made to compressor or arise in its operating behaviour, the compressor must be immediately shutdown and the fault reported to the responsible post/person.

Faults, especially those that could impair safety, must be immediately rectified. Otherwise the compressor must not be operated.

Work on the electrical equipment may only be carried out by a skilled electrician in accordance with electrical engineering rules and regulations.

Reference documents

These operating instructions only describe the DELCOS XL controller.

The operating instructions for the compressor must be observed in addition to these operating instructions.

1.2 Intended use

The installed controller DELCOS XL is exclusively intended for use with series L compressors from Gardner Denver.

1.3 Intentional misuse

Only changes authorised by Gardner Denver may be carried out on the controller, both where software and hardware are concerned.

1.4 Service

If you have any questions about or problems with the compressor please contact your responsible Gardner Denver agency.

The trained specialised personnel will ensure you receive quick and proper assistance.

In case of queries

If you have a query or wish to make a spare parts order, please specify the identification number and year of manufacture on the name plate. Specification of this data will ensure that you receive the correct information and/or spare parts.

Your Gardner Denver Deutschland GmbH agency

Please enter the details of your local Gardner Denver agency in the following table.

Name:	
Contact:	
Address:	
Phone	
Fax	
Email:	

Chart 1-1: Local Gardner Denver agency

2 SAFETY CONDITIONS

Gardner Denver Deutschland GmbH accepts no responsibility for material damage or injuries that arise from non-observation of safety conditions or the failure to observe normal levels of care and attention, even where this is not expressly stated in these operating instructions.

The operating instructions for the compressor must be observed in addition to these operating instructions.

2.1 Identification of safety instructions

Within the operating instructions, safety instructions are used as special warnings with the following described names and symbols.

These special warnings are intended to prevent danger and are located close to the possible danger both in terms of space and time:

- on the system close to the danger source
- in the operating instructions, before a sequence of actions / activity is described

Structure of safety instructions

The special warnings in the operating instructions are structured as follows:

DANGER WORD	
Safety sign	**Danger (danger sequence)** Description of the danger (danger source) Protective measure (danger prevention)

Parts of safety instructions

Danger (danger sequence): The danger sequence names the type of hazard.

Description of the danger (danger source): The danger source names the cause of the hazard.

Protective measure (danger prevention): Danger prevention describes the measures for combatting the hazard.

Danger word: The danger word subdivides the severity of the danger into four steps, graphically highlighted by different colours. The danger word is used in the safety instructions as described below.

DANGER indicates a directly dangerous situation which, if not protected against, could result in death or serious (irreversible) injuries.

WARNING indicates a potentially dangerous situation which, if not protected against, could result in death or serious (irreversible) injuries.

CAUTION indicates a potentially dangerous situation which, if not protected against, could result in minor or less serious (reversible) injuries.

ATTENTION indicates information or recommendations that directly or indirectly concern the safety of persons or system protection.

2.2 Safety sign

The following safety signs (danger signs) may be used in the surroundings of the compressor and in the operating instructions.

Safety sign	Meaning	Use / Behaviour
	General danger	Warning of a general danger. Observe the warning and proceed with the necessary caution (e.g. protective clothing) or care.
	Risk of slipping	Warning against the risk of slipping. Caution during walking, running or climbing.

Chart 2-1: Safety sign

Safety sign	Meaning	Use / Behaviour
	Pressurised part or system	Identification of devices or rooms in which there is permanently or occasionally a significantly higher air pressure than in the normal atmosphere. Do not open the devices or rooms before pressure equalisation has taken place.
	Never operate the compressor with open doors or loose enclosure panels.	Running the compressor with open doors or loose enclosure panels is forbidden except during test runs. High sound pressure level, risk of injury! Normal operation only with closed enclosure.
	Do not breath in any compressed air from this system	Use of the compressed air produced by this compressor as breathing air is forbidden. Drawn in substances could be harmful to health. Do not use compressed air as breathing air.
	Electrical voltage	Warning of dangerous, electrical voltage. Only a qualified electrician following electrotechnical regulations may carry out work on the electrical equipment of the compressor.
	System runs on	After pressing of the stop button <O>, the compressor runs on for 30 seconds. Do not open the compressor enclosure before the compressor is stationary.
	Observe the instruction manual	Identification of operating instructions where additional information is to be found in the operating instructions (of the manufacturer). Before the device is operated, the operator (user) must have read and understood the instruction manual (manufacturer's usage instructions).
	Wear ear defenders	Identification of areas with a heightened sound pressure level. Only enter the area wearing suitable ear defenders.
	Warning against industrial trucks	Warning of in-plant industrial trucks (e.g. forklifts) transporting materials. Do not carry out any work on traffic ways that cannot be seen to be clear and are not made safe or blocked off. Use or crossing of this traffic way can only be implemented with great care.
	Warning against suspended loads	Warning of suspended loads being transported. No person may remain in the danger area during transport. In particular, do not encroach into the area under the raised compressor or place your feet beneath it.

Chart 2-1: Safety sign

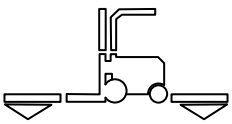
Safety sign	Meaning	Use / Behaviour
	Warning against moving machine parts	During maintenance work it is necessary to check some functions with an opened enclosure. There is a risk of injury due to rotating or translational movements. Maintenance work must only be carried out by specially trained personnel.
	Warning of hand injuries	Danger that the hands could be crushed, drawn in or otherwise injured. Maintain a safe distance.
	Warning of automatic start-up	In normal operating mode, the compressor may start up automatically at any time. The readiness for operation of the compressor is indicated by the green LED on the control panel. Do not carry out any work on the compressor, if the green LED illuminates.
	Warning of hot surfaces	Parts of the compressor become very hot during operation (up to 235 °C). Risk of injury due to hot surfaces. Before starting any maintenance and repair work, the compressor must be sufficiently cooled.
	Warning of suffocation	Risk of suffocation due to inadequate ventilation and extraction in the compressor room. The operator must provide adequate ventilation of the compressor room.
	Warning of crushing hazards	Warning of crushing hazards due to working materials (e.g. a machine) or a structural element (e.g. covers, enclosure panels, protection devices, boundary fences). When working on the identified workstations, increased awareness is necessary.
	Remaining under the load is forbidden	It is not permitted to remain under a suspended load. The driver is not permitted to drive the industrial truck if there is a person beneath the load. Moreover, the driver is obliged to check that persons do not stand or walk under the load. The load must only be transported so that it is sufficiently clear of the ground (max. 0.5 m above the ground). (In Germany, refer to the law BGV D27 "Industrial trucks"). The driver of an industrial truck is responsible for all driving and load movements.
	Lifting point	Identification of the lifting points. Only the indicated lifting points may be used for transport.

Chart 2-1: Safety sign

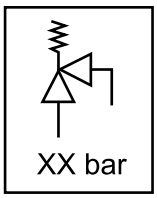
Safety sign	Meaning	Use / Behaviour
	Safety valve	Opening pressure of the safety valves (values "xx" see sticker on the control panel).
	Check the connecting terminals and tighten if necessary. For additional information see the operating instructions.	Warning against loosened connecting terminals. The clamping pressure can be released after some time. Regularly check the terminals according to the safety guidelines and retighten as necessary.
	Electrical voltage Residual voltage of the capacitors	Warning of dangerous, electrical voltage. Warning of electrical energy stores in the form of capacitors. These can conduct a life-threatening electrical voltage. Only open the switch cabinet (RS compressor or **ARV**) 10 minutes after switching the compressor voltage-free. Only a qualified electrician following electrotechnical regulations may carry out work on the electrical equipment of the compressor. **Der following section applies only for the frequency converter of the Allen Bradley manufacturer :** Check the DC bus voltage of the frequency converter at the mains connection strip of the frequency converter. The precise position of the terminals "DC+" and "DC-" can be taken from the supplied frequency converter operating instructions.
	Spring tension	Warning of tensioned spring inside the suction regulator. Before opening the suction regulator read the repair manual.
	Risk of microbe contamination	Warning against legionella contamination of the cooling water if an open cooling circuit is used. Constant monitoring of the cooling water by the maintenance personnel.
	Attention: hot liquid	Warning against hot oil or hot coolant. Before opening coolant circuits, allow the compressor to cool.

Chart 2-1: Safety sign

NOTE

All danger signs must be complete and legible.
Check regularly and replace if necessary.

3 CONTROL PANEL AND CONTROL

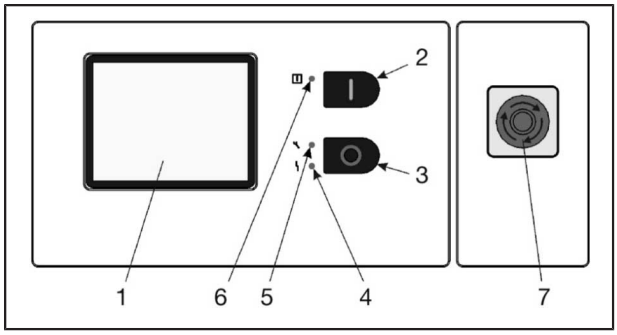


Fig. 3-1: Control panel

[1] Touchscreen display

[2] Start button < I >.

[3] Stop button < O >

[4] red LED
flashing slowly: warning or maintenance
flashing rapidly: Fault

[5] yellow LED
flashing slowly: Maintenance necessary

[6] green LED
lit up permanently: System in operation
Flashing: System in standby

[7] Pushbutton <Emergency-stop>

About the compressor controller

Essentially, the controller regulates:

- compressor starting and stopping
- speed control (**RS**) and switching the compressor between on-load and off-load in response to variations in air demand
- the monitoring of various operating parameters such as pressures and temperatures
- display of any warning/fault messages and automatic shut-down in the event of a fault
- data entry for adjustment of various operating parameters
- keeping track of scheduled maintenance of the compressor.

3.1 General handling / entry of parameters

Input menus

If it is necessary to adjust parameters in a menu or make other entries, the corresponding input menu is always displayed.

The input menus are, as far as possible, self-explanatory.

Selection

If it is only possible to choose between fixed defined values for entry, the corresponding selection input menus are displayed.

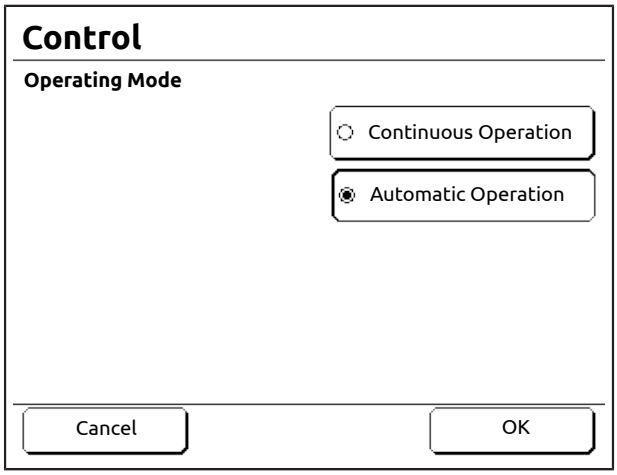


Fig. 3-2: "Selection" input menu, example "Operating Mode"

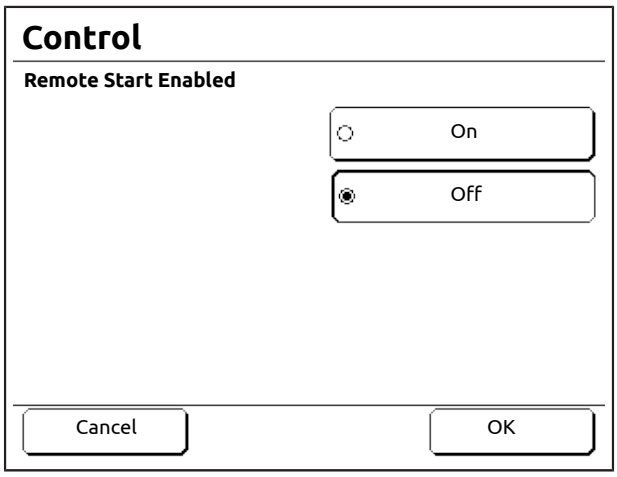


Fig. 3-3: "Selection" input menu, example "Remote Start Enabled"

If necessary, the input menus are supplemented with an explanatory text.

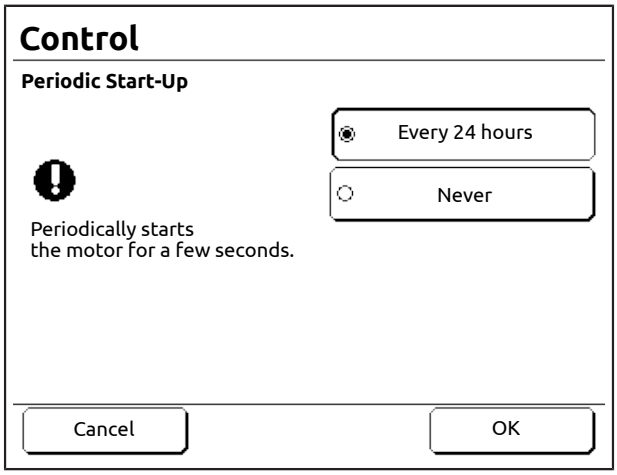


Fig. 3-4: Input menu with an explanatory text

Parameters

If parameters must be entered, an appropriate soft keypad is displayed. Alongside the statement of the parameter that can be entered by the input, the possible adjustment range is displayed.

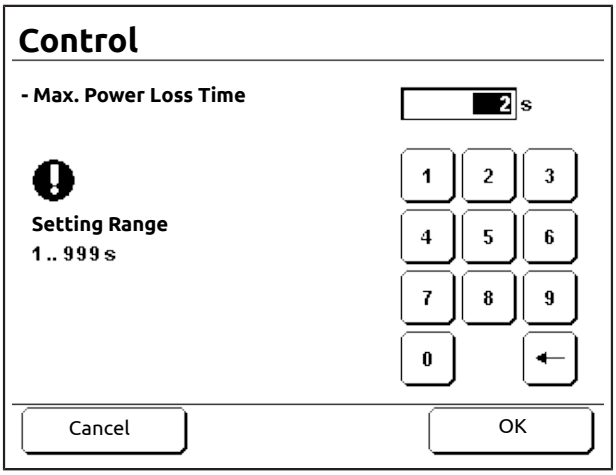


Fig. 3-5: Soft keypad

Additional information

Where necessary, information about a particular menu is given.

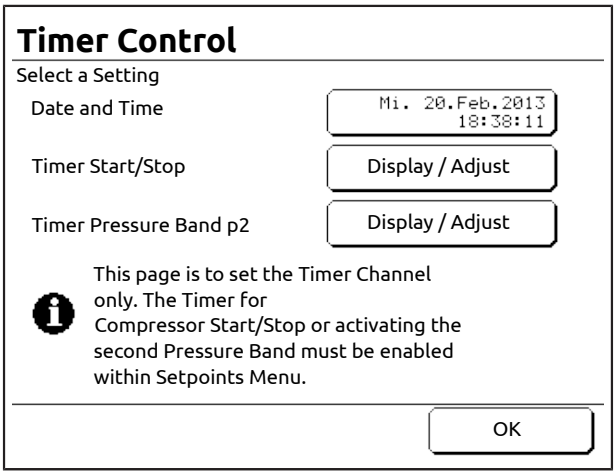


Fig. 3-6: Menu with additional information

Access Code

Input menus for access codes always have an indication about the status of the current access authentication.

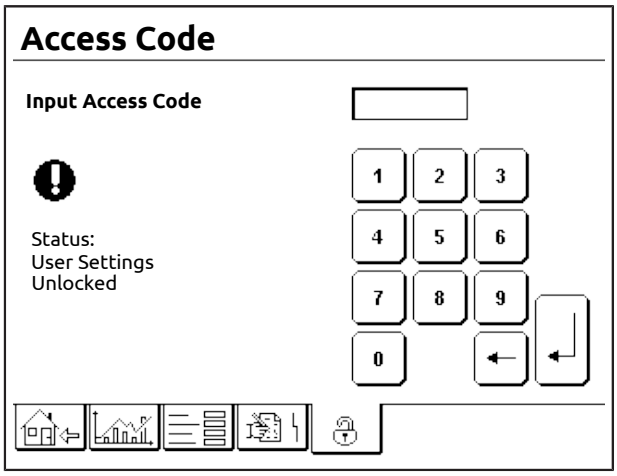


Fig. 3-7: Access code input menu

Arrow keys

If the content of a menu does not fit on the display, arrow keys are displayed with which the menu content can be scrolled through.

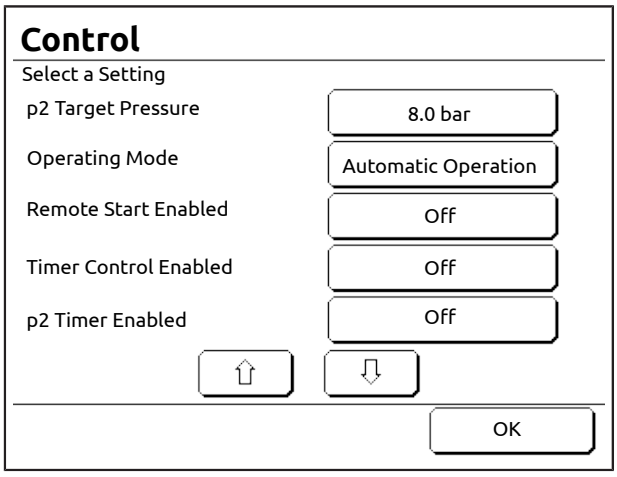
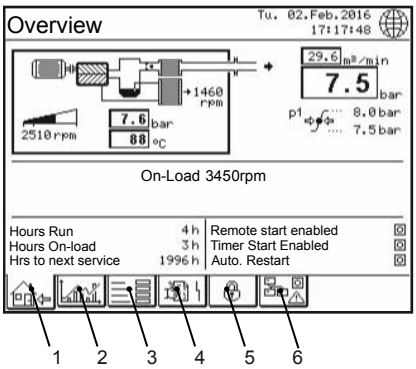


Fig. 3-8: Menu with arrow keys

4 MENUS

4.1 Menu Structure



(1) Overview
Time and date / Language selection Operating display (pictogram with measuring values and setpoints) Status / Message area Hours run / Service hours Switch-on functions status

(2) Trends
Statistics On-Load Hours Statistics Weekly Profile Volume flow Line pressure Motor speed **(RS)** Additionally on the maintenance level: - Discharge pressure - Discharge temperature - Heatsink Temperature **(RS)** - VSD Output Current **(RS)** - Motor speed of fan G2 **(ARV)** Additionally in the Base Load Sequencing: - Volume flow (BLS) - Statistics Weekly Profile (BLS)

(3) Settings
Hour Meters Control system Timer Programmable inputs / outputs Communication Configuration Factory Settings SD card

(4) Fault History
List of alarms with display of alarm details

(5) Access Code
Input Menu “Input Access Code”

(6) Base Load Sequencing (optional)
Base Load Sequencing switching on / off Settings: - Setpoints - Behaviour - Timer - Configuration

Fig. 4-1: Menu Structure

4.2 Menu "Home"

The menu "Home" is the basic screen that is displayed during normal operation.

It is called via the <Home> tab.
If no entry is made for five minutes, this menu appears automatically.

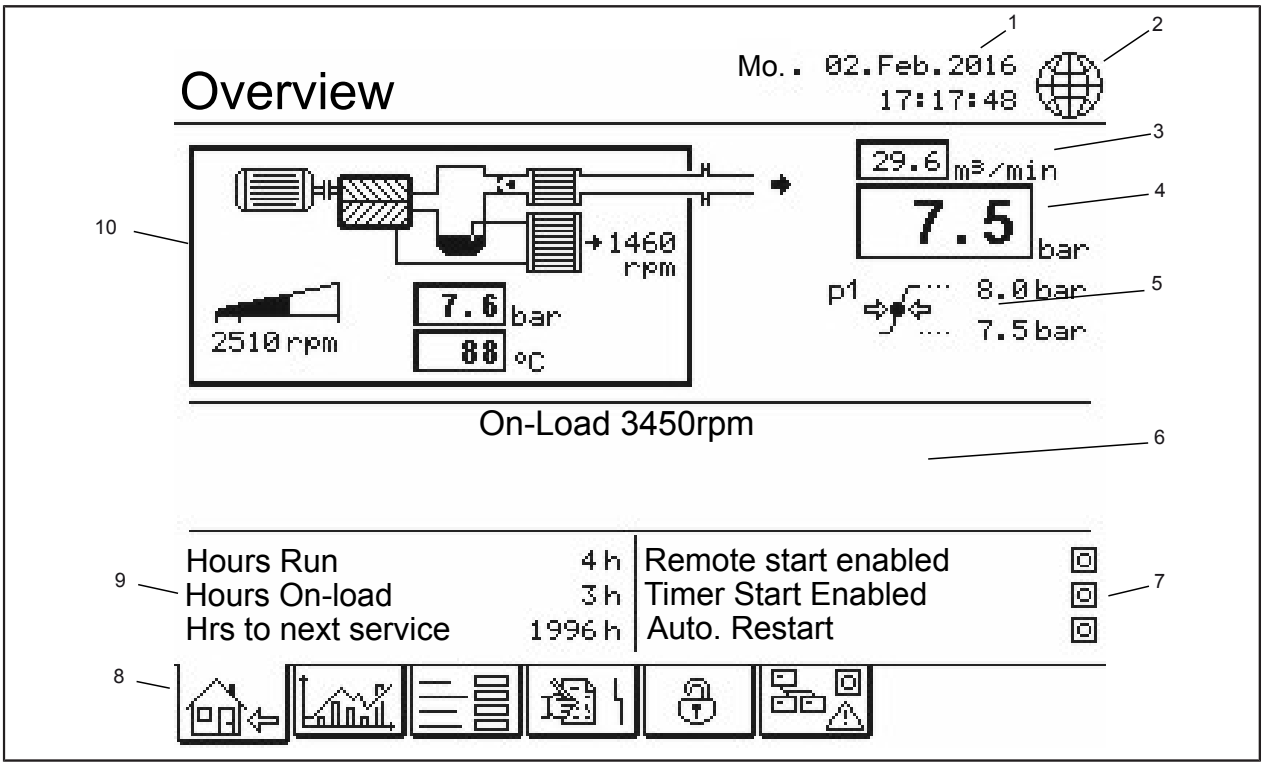


Fig. 4-2: Menu "Home"

[1] time and date
[2] Direktzugriff <"Sprachauswahl">
[3] Volume flow
[4] Line pressure
[5] Druckband
[6] Status / Message area
[7] Switch-on functions status
[8] Registerkarten
[9] Serviceinformationen
[10] Piktogramm

[1] Date / Time

Display of the current date and time.

[2] Direct access <"Language">

Tapping the globe symbol opens the menu "Choose Language" directly. See also the chapter "Configuration / Set language".

[3] Volume flow

Display of the currently supplied volume flow.

The current volume flow is calculated based on the motor speed (**RS**) and the delivered air quantities set in the menu "Configuration".

[4] Network pressure

Display of the current air pressure in the compressed air network.

[5] Pressure band

Display of information about the current pressure band, within which the compressor attempts to maintain the set air pressure in the compressed air network. See chapter "Configuration / Set pressure bands".

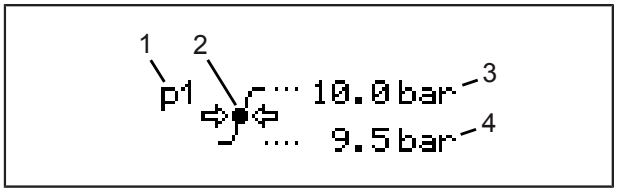


Fig. 4-3: Information about the current pressure band

[1] Current pressure band
[2] International pressure symbol
[3] Upper pressure value
[4] Lower pressure value

[5.1] Current pressure band

Display of the currently used pressure band.

"p1" is the normal pressure band that is used as standard.

"p2" is a second pressure band that can be used if a different line pressure is required. The second pressure band can be switched to using the integrated timer control (see chapter "Timer control operation") or using an external contact (see chapter "Programmable Inputs and Outputs".

[5.3] Upper pressure values

The air pressure at which the controller switches the compressor to off-load operation (**RS**: The drive motor runs at minimum speed). The run-on timer is activated and the compressor switches in "x" seconds to standby mode, if no pressure demand is applied before the end of the run-on time.

[5.4] Lower pressure values

RS: "Target pressure"; Air pressure which the controller attempts to maintain.

FS: "Cut-In Point."; Air pressure at which the controller switches the compressor to on-load operation.

NOTE

If the pressure band is controlled via other sources, this is indicated by symbols.

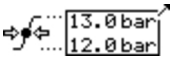
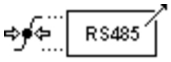
Symbol	Explanation
	Control of the pressure band via the RS485:1 port (**RS**)
	Control of the On-/Off-load commands via the RS485:1 port (**FS**)
	Control of the pressure band via the optional base load sequencing function.

Chart 4-1: Symbols when using other pressure band sources

[6] Status-/ message area

The status of the compressor is indicated in the top row in defined status messages.

Compressor warnings are displayed in the bottom row.

The possible status warnings and explanations are summarised in a table in the appendix to these operating instructions.

[7] Status switch on functions

The following switch on functions are available:

- Remote Start
- Timer Control
- AutomaticRestart

[7.1] Status remote start

The status of the switch on functions is indicated in the checkbox.

I: Remote start activated. Remote start possible.

O: Remote start deactivated. No remote start possible.

Details and setting, see chapter "Configuration / Advanced Settings".

[7.2] Status timer control-start

The status of the timer control enable is indicated in the checkbox.

I: Timer control activated. Start/Stop via timer control possible.

O: Timer control deactivated. No Start/Stop via timer control possible.

Details and setting, see chapter "Configuration / Advanced Settings".

[7.3] Status Auto. Restart Enabled

The status of the function "Auto. Restart Enabled After a Power Failure" is indicated in the checkbox.

I: Function activated. The compressor can automatically restart after a power failure.

O: Function deactivated. The compressor must be manually restarted after a power failure.

Details and setting, see chapter "Configuration / Advanced Settings".

[8] Tabs

The main menus of the controller are called from the tabs.

The following tabs are available:

Symbol	Name	Description
	<Home>	Normal operating display.
	<Trends>	Display of various compressor statistics or trends over a defined time period.
	<Settings>	Display and option for editing various compressor operating settings.
	<Fault history>	Listing of the most recent faults and warnings (maximum 64) and further information about each event.
 	<Access Code>	Display of the soft keypad for entry of codes for enabling particular settings.
	<Base Load Sequencing>	(Option) Display of the menu for control of the base load sequencing function.

Chart 4-2: Tabs

[9] Service information

The following service information is displayed:

- Operating hours
- Load hours
- Hours until the next maintenance is due

[9.1] Operating hours

Display of the drive motor running hours.

[9.2] Load hours

Display of compressor on-load running hours.

[9.3] "Hours to next Service..."

Indicates how many hours until the next service is due.

[10] Pictogram

Display of measured values. To display other readings, the pictogram view can be changed.

See the next chapter for a description.

4.3 Pictogram

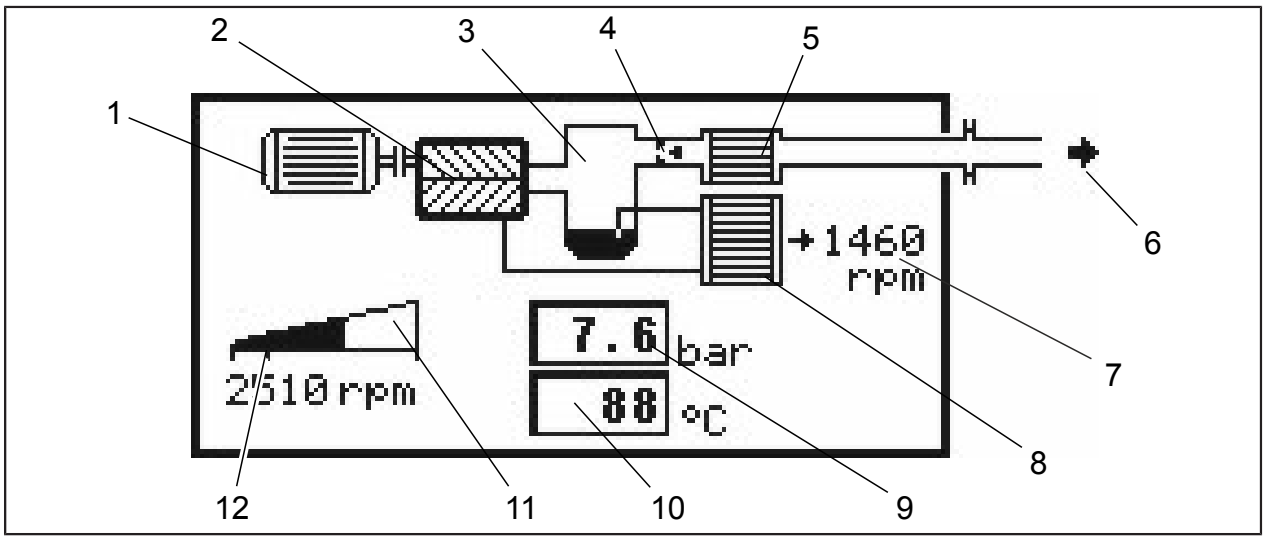


Fig. 4-4: Pictogram

[1] Drive motor

[2] Screw compressor stage

[3] Pressure vessel

[4] Pressure-retaining and non-return valve

[5] Aftercooler

[6] Air delivery

[7] RPM fan motor (option)

(only for a speed-controlled fan blower (ARV))

[8] Oil cooler

[9] Pressure in the pressure vessel

[10] Temperature outlet compressor stage

[11] Drive motor speed (graphical and numerical)

(only for a speed-controlled compressor system)

[12] Drive motor speed markings (standstill, off-load, max.)

(only for a speed-controlled compressor system)

4.4 Menu "Trends"

The menu "Trends" comprises four graph screens (**FS**) or five graph screens (**RS**).

The following graph screens are available:

- Statistics on-load hours
- Statistics Weekly Profile
- Volume flow
- Network pressure
- Motor speed(**RS**)

It is called via the <Trends> tab.

Changing between the individual graph screens is undertaken using the <arrow keys> in the top screen edge.

Statistics on-load hours

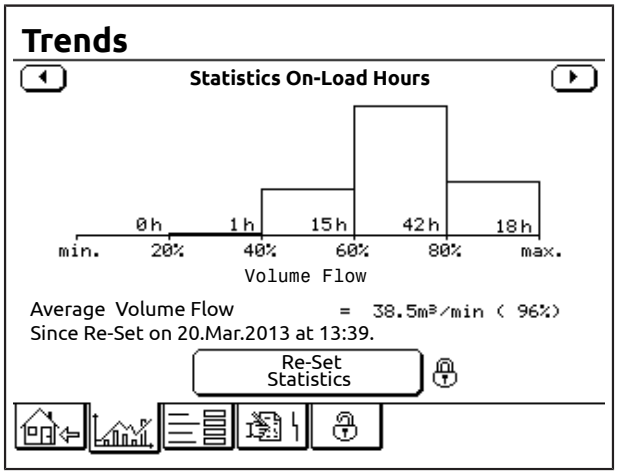


*Fig. 4-5: Graph Screen "Statistics On-Load Hours" (**RS**)*

This bar graph shows how many hours the RS compressor has been operated with various volume flows. It also shows the average total volume flow since the last reset.

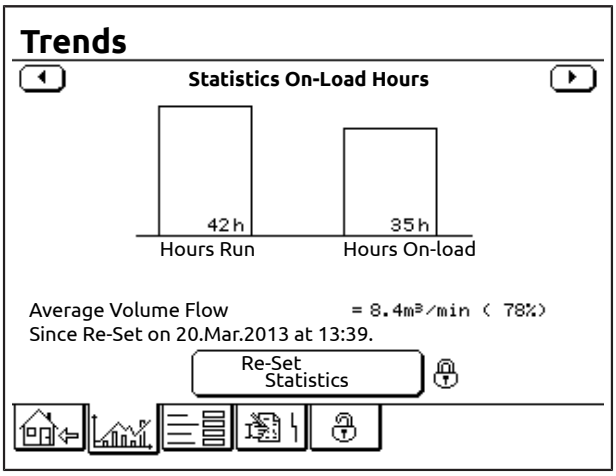


*Fig. 4-6: Graph screen "Statistics On-Load Hours" (**FS**)*

This bar graph shows how many hours the FS compressor has been running (total hours and on-load). It also shows the average volume flow since the last reset.

Statistics Weekly Profile

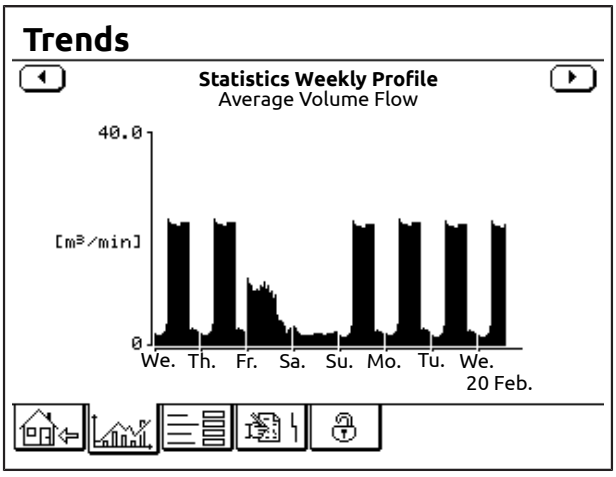


Fig. 4-7: Graph screen "Statistics Weekly Profile"

This bar graph shows the average hourly volume flow over the last 8-days.

Volume flow

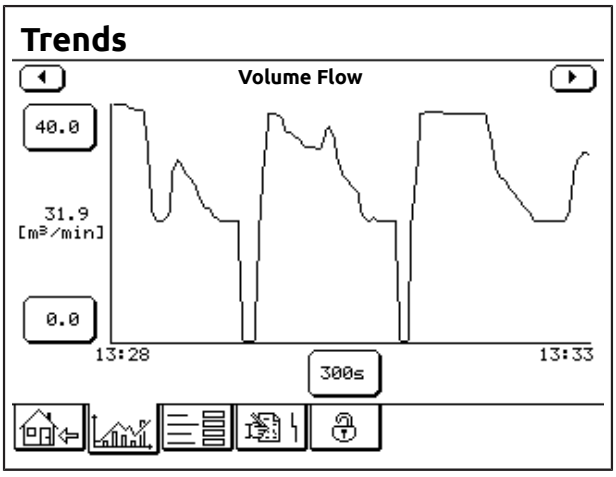


*Fig. 4-8: Graph screen "Volume Flow" (Example **RS**)*

This graph shows the variation in the volume flow over a specified period.

Network pressure

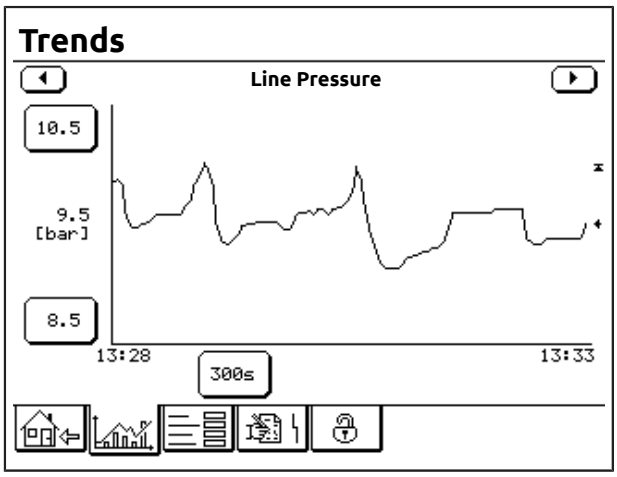


Fig. 4-9: Graph screen "Line Pressure"

This graph shows the variation in pressure in the compressed air network over a specified period.

Motor speed(RS)

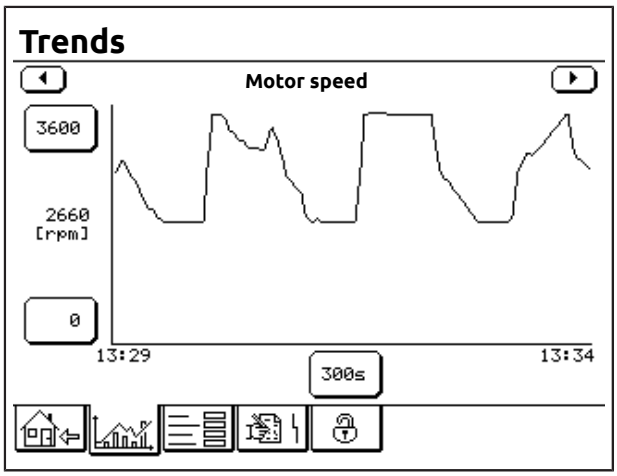


Fig. 4-10: Graph screen "Motor Speed"

This graph shows the variation in the motor speed over a specified period.

Contents of line graphs

X-axis; time axis

Y-axis; parameter value axis: the actual value is displayed on the left alongside the graph

<Button> on the X-axis; scale the X-axis.

<Button> on the Y-axis; scale the Y-axis.

Scaling the Y-axis

Adjust the upper limit of the graph.

1 Tap the Y-axis <Upper button>.

– The input menu "Trend Upper Limit" appears.

2 Tap the <Number buttons> to enter the Trend Upper Limit.

3 Tap the <OK> button.
   – The entries are accepted.
   – The Y-axis scale is accordingly adjusted.

Data entry can be cancelled by tapping the button <Cancel>.

Adjust the lower limit of the graph.

1 Tap the Y-axis <Lower button>.
   – The input menu "Trend Lower Limit" appears.

2 Tap the <Number buttons> to enter the Trend Lower Limit.

3 Tap the <OK> button.
   – The entries are accepted.
   – The Y-axis scale is accordingly adjusted.

Data entry can be cancelled by tapping the button <Cancel>.

Scaling the X-axis

Adjust the width of the graph.

1 Tap the X-axis <Button>.
   – The input menu "Trend Time Axis" appears.

2 Tap the desired option.
   – The entries are accepted.

3 Tap the <OK> button.
   – The X-axis scale is adjusted accordingly.

Data entry can be cancelled by tapping the button <Cancel>.

4.5 Menu "Settings"

NOTE

All specific settings should be recorded, so that if necessary they are available (e.g. for setting up a replacement controller).

The settings can be entered in the "Adjustment values" table in the appendix to these operating instructions.

The menu "Settings" offers a selection of options that can be individually adjusted so that the compressor is used in accordance with requirements.

The menu is called via the tab <Settings>.

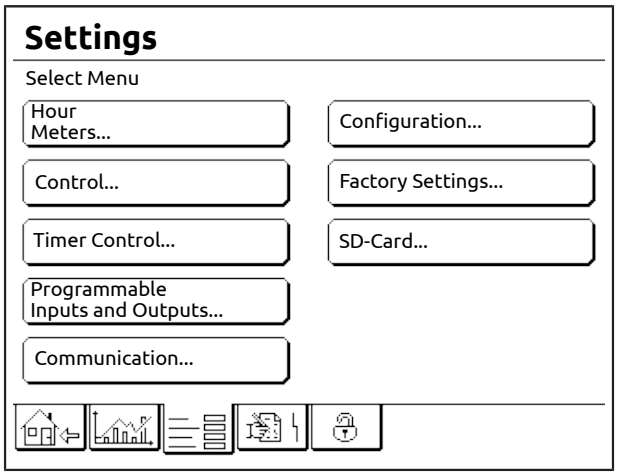


Fig. 4-11: Menu "Settings"

The following sub-menus can be called from the "Settings" menu:

- "Hour Meters..."; to adjust the service intervals
- "Control..."; to adjust the compressor operating behaviour
- "Timer Control..."; to set the date and time plus time management
- "Programmable Inputs and Outputs..."; to configure functions and connected devices
- "Communication..."; to configure RS485 interface(s)
- "Configuration..."; to configure compressor data, language, etc.
- "Factory Settings..."; view for customer service
- "SD-Card..."; switching-on and –off of data recording

Hour Meters

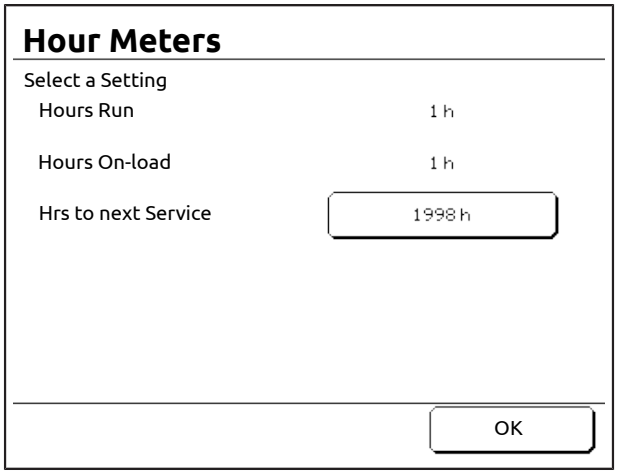


Fig. 4-12: Sub-menu "Hour Meters"

The menu "Hour Meters" indicates:

- "Hours Run"; display of the drive motor running hours.
- "Hours On-load", display of compressor on-load running hours.
- "Hours to next Service"; time until the next service (service interval).
  The time until the next service can be set by the service personnel. See chapter "Advanced operation / Setting the service interval".

Control

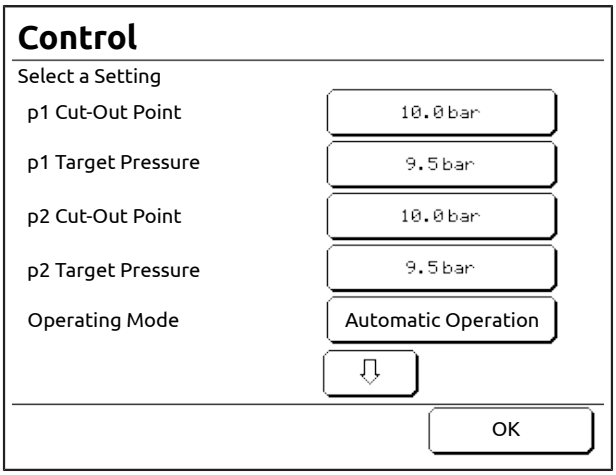


*Fig. 4-13: Sub-menu "Control" (example **RS**)*

The "Control" menu is used to configure the compressor operating behaviour. The following sub-menus are available.

The display can be scrolled using the arrow keys to permit display of other points.

- "p1 Cut-Out Point"; to configure the pressure band. See chapter "Configuration / Set pressure bands".
- "p1 Cut-In Point" (**FS**) / "p1 Target Pressure" (**RS**); to configure the pressure band. See chapter "Configuration / Set pressure bands".
- "p2 Cut-Out Point"; to configure the second pressure band. See chapter "Configuration / Set pressure bands".
- "p2 Cut-In Point" (**FS**) / "p2 Target Pressure" (**RS**); to configure the second pressure band. See chapter "Configuration / Set pressure bands".
- "Operating mode"; to set the operating mode. See chapter "Operating / Operating modes".
- "Enable Remote Start"; to enable the remote start option. See chapter "Configuration / Set Remote Start and Stop".
- "Timer start enabled"; to enable timer control operation. See chapter "Configuration / Timer Control Operation".
- "p2 Timer Enabled"; to enable timer control operation for the second pressure band. See chapter "Configuration / Timer Control Operation".
- "Automatic re-start"; to enable automatic restart after a power failure. See chapter "Configuration / Setting Automatic Restart After a Power Failure".
- "- Max. Power Loss Time"; to configure the behaviour upon automatic restart after a power failure.
- "- Restart Delay"; to configure the behaviour upon automatic restart after a power failure.
- "Dryer Pre-Run Time"; to configure the compressor for operation with an external dryer. See chapter "Configuration / Setting the Dryer Pre-Run Time".

Timer Control

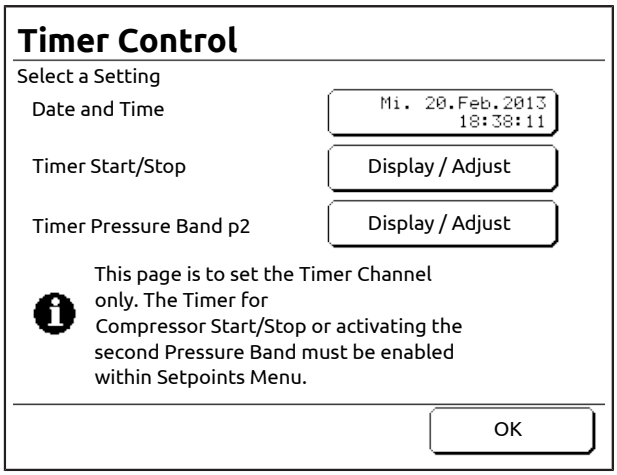


Fig. 4-14: Sub-menu "Timer Control"

In the menu "Timer Control" settings can be made for timer control operation; in addition date and time can be set.

The following sub-menus are available.

- "Date and Time"; to set the date and time. See chapter "Configuration / Set Date and Time".
- "Timer Start/Stop"; to configure timer control operation. See chapter "Configuration / Timer Control Operation".
- "Timer Pressure Band p2"; to configure timer control operation in the second pressure band. See chapter "Configuration / Timer Control Operation".

Programmable Inputs and Outputs

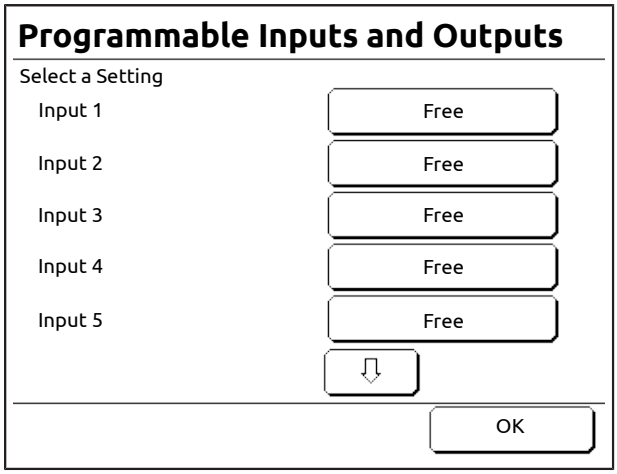


Fig. 4-15: Sub-menu "Programmable Inputs and Outputs"

Programmable inputs can be used to monitor connected devices, or functions can be set up that influence compressor operation.

Programmable outputs can be used to forward status messages from compressors, e.g. to a higher level control room.

The menu "Programmable Inputs and Outputs" is used to allocate inputs and outputs. See chapter "Configuration / Programming Inputs and Outputs" for details on configuring inputs and outputs.

Communication

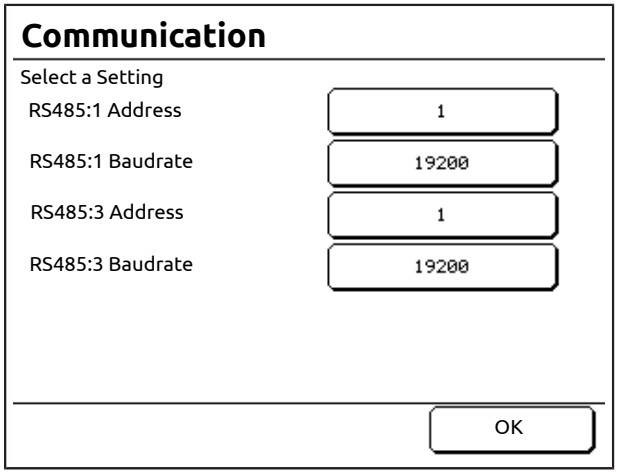


Fig. 4-16: Sub-menu "Communication"

In the menu "Communication" you can specify the communications settings for the RS485 port (designation: RS485:1). Optionally a further RS485 interface (designation: RS485:3) is available.

To configure the interfaces, see chapter "Configuration / Setup RS485 Communication".

Configuration

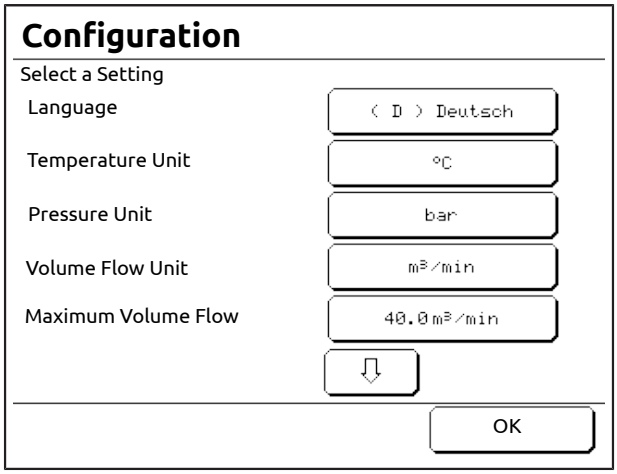


Fig. 4-17: Sub-menu "Configuration"

In the menu "Configuration" the compressor data can be set to the preferred measurement units.

The following sub-menus are available.

The display can be scrolled using the arrow keys to permit display of other points.

- "Language"; to set the display language. See chapter "Configuration / Set language".
- "Temperature Unit"; to set the temperature unit. See chapter "Configuration / Setting Measurement Units".
- "Pressure Unit"; to set the pressure unit. See chapter "Configuration / Setting Measurement Units".
- "Volume Flow Unit"; to set the volume flow rate. See chapter "Configuration / Setting Measurement Units".
- "Maximum Volume Flow"; to set the maximum volume flow, which is used in the calculation for the volume flow rate display. Ex works this setting is pre-set to a mean value. Dependent on the actually set line pressure, the value can be finely adjusted here.
- "Minimum Volume Flow" (**RS**); to set the minimum volume flow, which is used in the calculation for the volume flow rate display. Ex works this setting is pre-set to a mean value. Dependent on the actually set line pressure, the value can be finely adjusted here.
- "Ext. Speed Limit (min)" (**RS**); if necessary, this adjustable speed limit can be switched on via a programmable input. See chapter "Configuration / Programmable Inputs".
- "Ext. Speed Limit (max) (**RS**); Via a programmable input this speed limit can be switched on, if required. See chapter "Configuration / Programmable Inputs".

Factory Settings

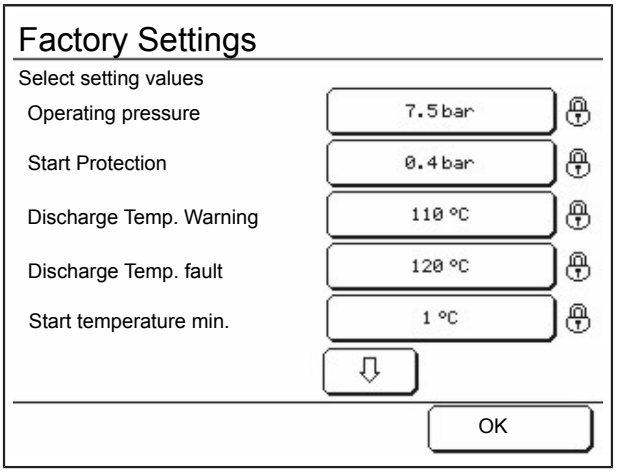


Fig. 4-18: Sub-menu "Factory Settings"

The menu "Factory Settings" shows the factory settings of the control.

Some values can be changed at the service level, see chapter "Advanced operation / maintenance Level".

The display can be scrolled using the arrow keys to permit display of other points.

- "Operating pressure"; rated operating pressure that can be produced using the compressor.
- "Start Requ. Approval"; below the set tank pressure, the compressor can be restarted.
- "Heavy Startup"; if the tank pressure reaches this value during the start phase, the compressor is stopped. (compressor without speed control)
- "Discharge Temp. Warning"; air temperature warning limit at the airend outlet.
- "Discharge Temp. Fault"; if the airend temperature reaches the set value, the compressor is stopped.
- "Minimum Start Temperature"; minimum temperature (water temperature jacket cooling), at which the compressor can be started.
- "Discharge Temp. Control"; only **ARV** systems. In the "Auto" setting the target Disch. Temp. is controlled via the fan-oil cooler in relation to the nominal pressure.
- "Run-On Time"; drive motor off-load period before the compressor is stopped and switched to standby mode.
- "Soft Stop Time"; off-load period of the drive motor before the compressor is stopped. For manual or remote stop.
- "Star-Delta"; factory set star-delta switchover time. (compressor without speed control)
- "Cooling Control"; air control in idle (Thermostatic controlled or continuous operation [Permanent]). Not for **ARV**.
- "Software version"; software version of the controller.
- "Controller Ref.-No."; serial number of the controller.
- "Compressor Ref.-No."; serial number of the compressor.

SD-Card

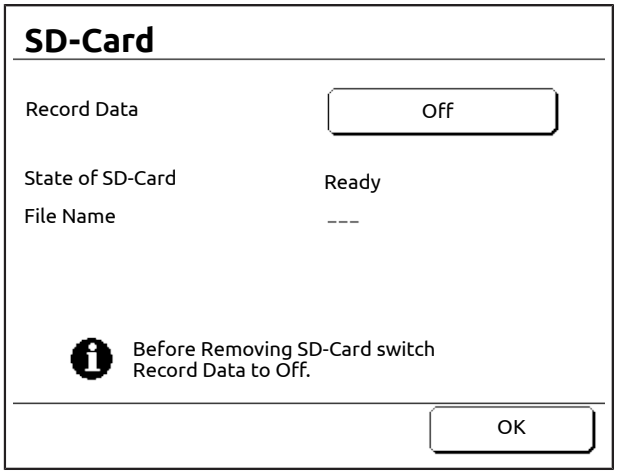


Fig. 4-19: Sub-menu "SD-Card"

The controller has a data recording (data logger) function by recording of data to an SD-Card.

The record data function is switched on and off via this menu. See chapter "Advanced operation / Data Recording".

4.6 Menu "Fault History"

The controller stores the last 64 alarms (faults and warnings) which have occurred.

The alarms are displayed in a list, with the most recent appearing at the top. If the list exceeds 64 alarms, the oldest alarm will be overwritten.

A flashing symbol to the left alongside the alarm shows that this alarm is still active (not yet reset). Additionally the symbol flashes on the tab <Fault History>.

Fault overview

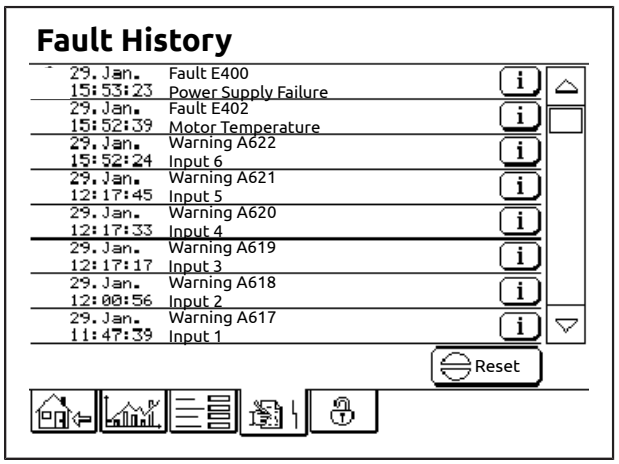


Fig. 4-20: Menu "Fault History"

Each alarm is saved with the date and time of its occurrence.

The alarm list can be scrolled using the arrow keys.

The button <i> on the right side of the menu row is used to display the readings recorded at the time of occurrence of the alarm alongside other information about the alarm.

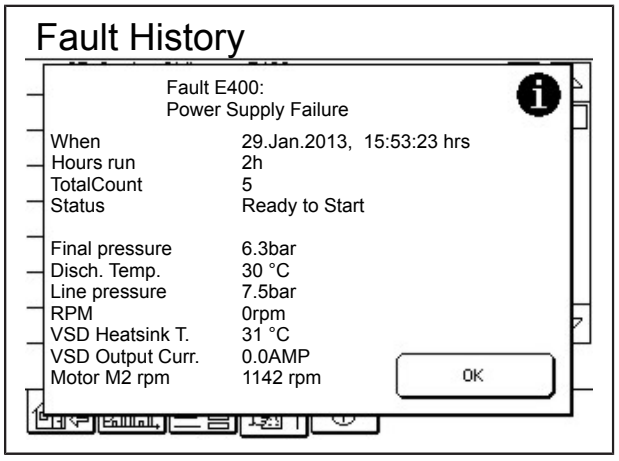


Fig. 4-21: Information about the selected alarm

The contents can be scrolled using the arrow keys.

Alarm acknowledgement

After the cause of the alarm has been cleared, the alarm must be reset in the controller.

1 Clear the cause of the alarm.

2 Tap the <Fault History> tab.

3 Tap the <Reset> button.

✓ The outstanding alarm(s) is (are) reset.

– The flashing alarm symbol disappears.

– The symbol on the <Fault History> tab stops flashing.

Alarms that are still uncleared cannot be reset. The alarm symbol and the symbol on the <Fault History> tab continue to flash.

4.7 Menu "Access Code"

Codes for particular operating options can be entered in the menu "Access Code".

The following access codes are available to the customer's personnel.

Code	Operator function
1234	Activate and deactivate base load sequencing (option).
3031	Enable and block user entries; if blocked, no parameter entry is possible.
3100	Enable and block the maintenance level; advanced operator functions.

Chart 4-3: Customer access codes

NOTE

The maintenance level is automatically blocked after five minutes, the controller automatically activates the user level.

Entering and using access codes

1 Tap the <Access Code> tab.

– The input mask "Access Code" appears.

2 Tap the <Number buttons> to enter the appropriate access code.

3 If necessary, make any corrections with the <Back> button.

4 Tap the <Enter> button.

– The access code is transferred to the controller.

– The corresponding operating functions are enabled.

To withdraw the function, enter the same access code again.

5 CONFIGURATION

5.1 Choose Language

1 Tap the <Globe Symbol> in the "Home" menu.
– The menu "Choose Language" appears.

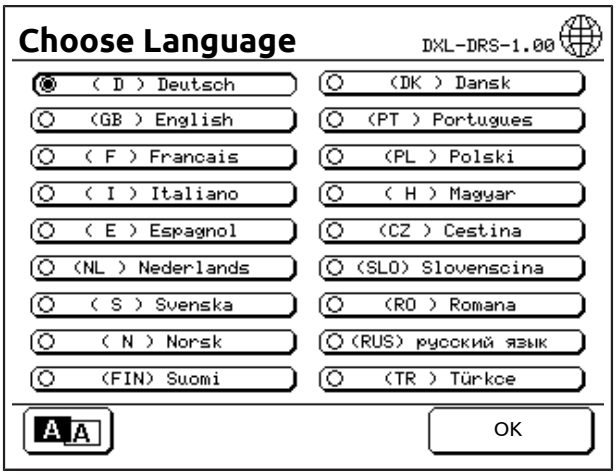


Fig. 5-1: Menu "Choose Language"

2 Tap the <Button> for the desired language.
– The display language is selected.

3 Tap the <OK> button.

✓ The display language is changed to the selected language.

NOTE

The language can also be selected via "Settings" / "Configuration" / "Language".

1 Tap the <Settings> tab.
– The menu "Settings" appears.

2 Tap the <Configuration> button.
– The menu "Configuration" appears.

3 Tap the <Language> button.
– The menu "Choose Language" appears.

4 Tap the <Button> for the desired language.
– The display language is selected.

5 Tap the <OK> button.

✓ The display language is changed to the selected language.

5.2 Inverting the screen output

1 Tap the <Globe Symbol> in the "Home" menu.
– The menu "Choose Language" appears.

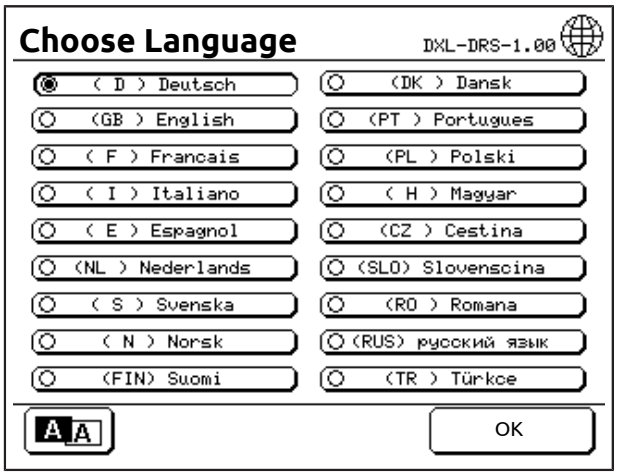


Fig. 5-2: Menu "Choose Language"

1 Tap button <A/A>.

✓ The screen output changes from "white on blue" to "blue on white" and vice versa.

5.3 Setting the date and time

1 Tap the <Settings> tab.
– The menu "Settings" appears.

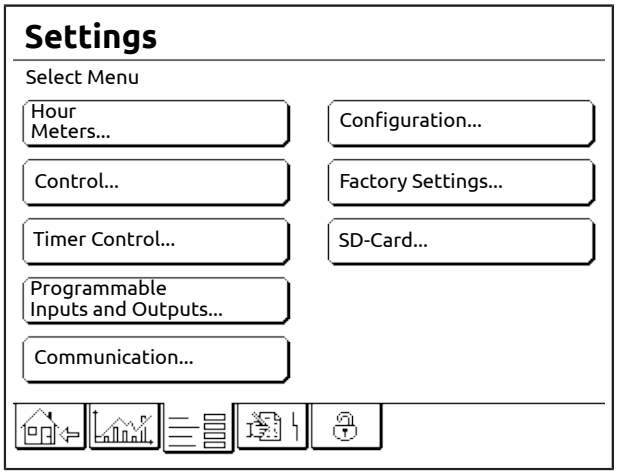


Fig. 5-3: Menu "Settings"

2 Tap the <Timer Control...> button.
– The menu "Timer Control" appears.

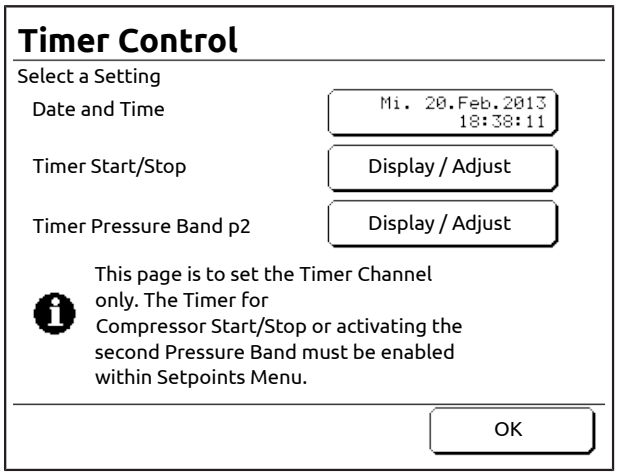


Fig. 5-4: Menu "Timer Control"

3 Tap button <Date and Time>.

– The "Date and Time" input mask appears.

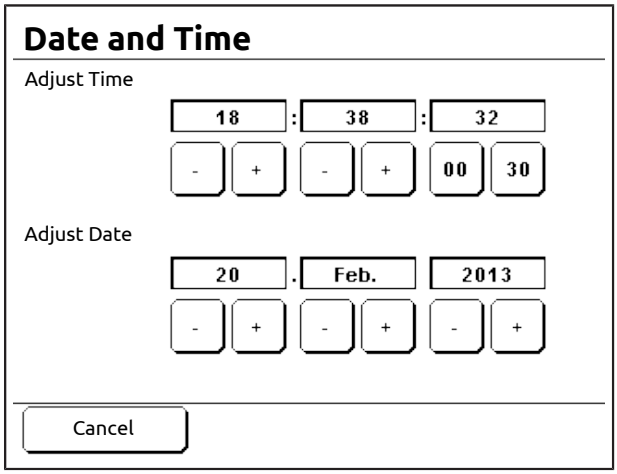


Fig. 5-5: Input mask "Date and Time"

4 Adjust the date and time using the <+> and <-> buttons.

– As soon as a button is tapped, the <OK> button appears.

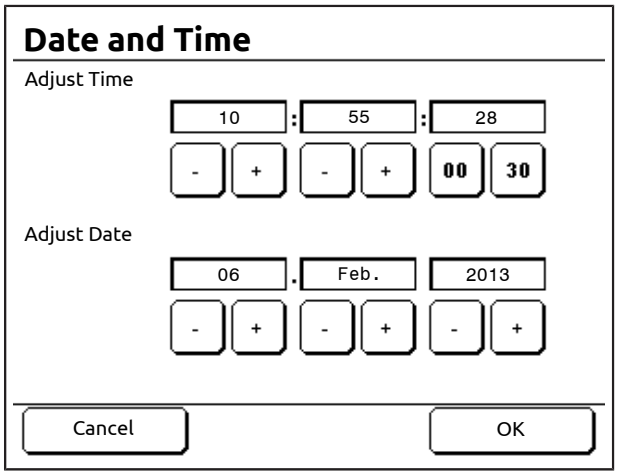


Fig. 5-6: Input mask "Date and Time"

The <Cancel> button can be used to cancel setting of the date and time.
The previously active date and time are used.

5 Tap the <OK> button.

✓ The set date and time are saved.

NOTE

To simplify synchronising the time with an external time source, the seconds can be set to "00" or "30".
They then only start running if the button <OK> is touched.

5.4 Setting the measurement units

Setting the temperature unit

1 Tap the <Settings> tab.

– The menu "Settings" appears.

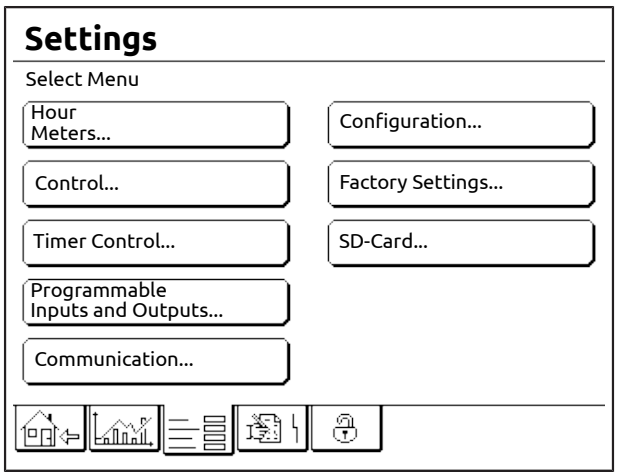


Fig. 5-7: Menu "Settings"

2 Tap the <Configuration...> button.

– The menu "Configuration" appears.

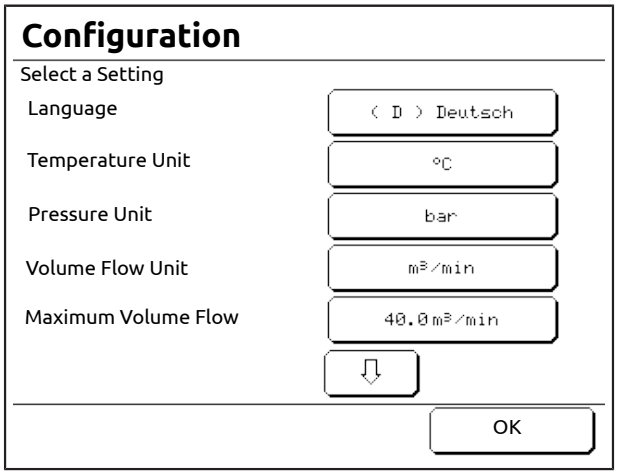


Fig. 5-8: Menu "Configuration"

3 Tap the button <Temperature Unit>
– The input menu "Temperature Unit" appears.

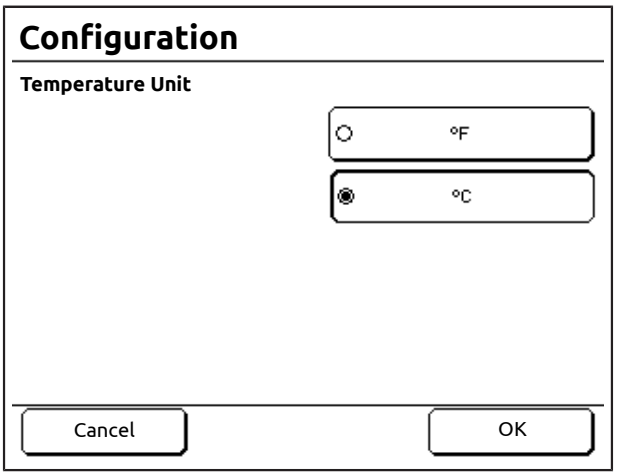


Fig. 5-9: Input menu "Temperature Unit"

4 Tap the button <°F> or <°C>, to select the temperature unit.
5 Tap the <OK> button.
✓ The temperature unit is set.

Setting the pressure unit

1 Tap the <Settings> tab.
– The menu "Settings" appears.

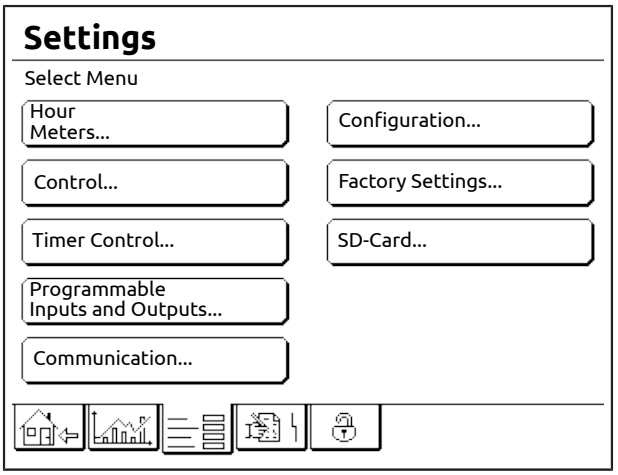


Fig. 5-10: Menu "Settings"

2 Tap the <Configuration...> button.
– The menu "Configuration" appears.

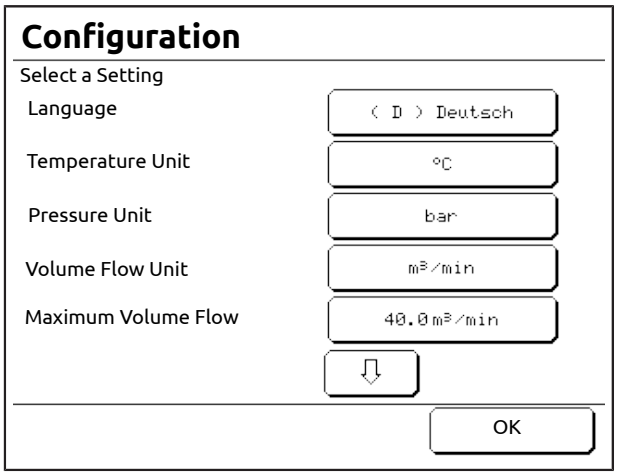
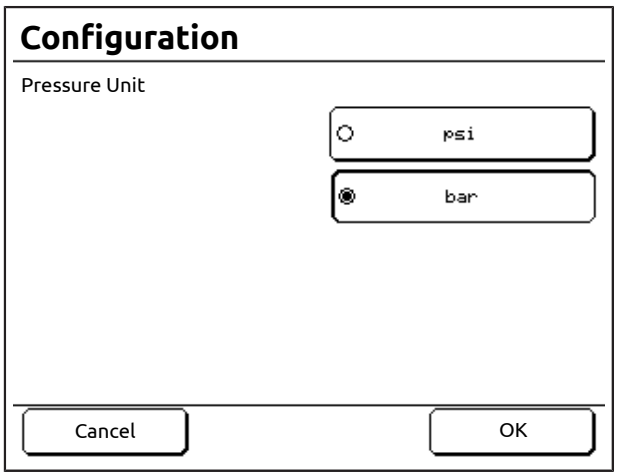


Fig. 5-11: Menu "Configuration"

3 Tap the button <Pressure Unit>.
– The input menu "Pressure Unit" appears.



4 Tap the button <bar> or <psi>, to select the pressure unit.
5 Tap the <OK> button.
✓ The pressure unit is set.

Setting the volume flow rate unit

1 Tap the <Settings> tab.
– The menu "Settings" appears.

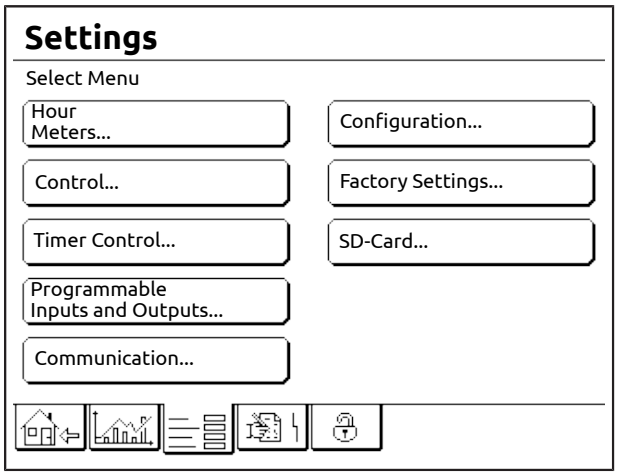


Fig. 5-12: Menu "Settings"

2 Tap the <Configuration...> button.

– The menu "Configuration" appears.

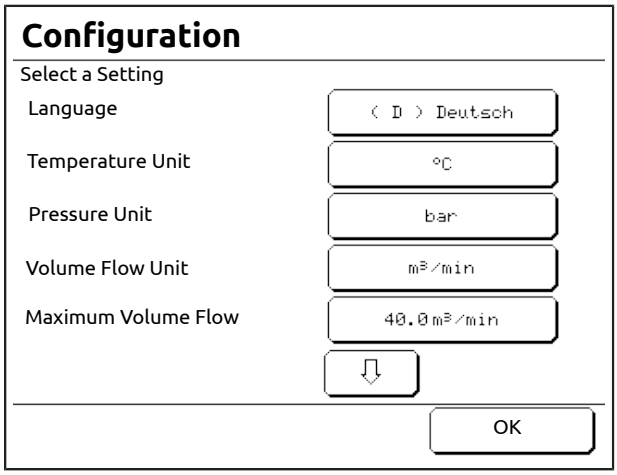
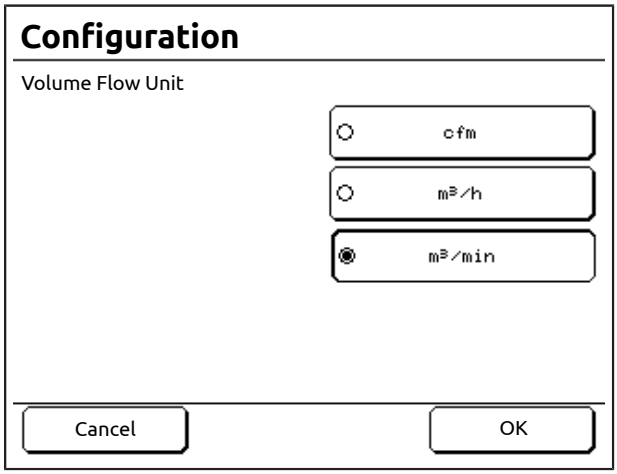


Fig. 5-13: Menu "Configuration"

3 Tap the button <Volume Flow Unit>.

– The input menu "Volume Flow Unit" appears.



4 Tap the button <cfm>, <m³/h> or <m³/min> to select the volume flow unit.

5 Tap the <OK> button.

✓ The volume flow rate unit is set.

5.5 Advanced Settings

5.5.1 Setting the pressure bands

Pressure bands

The range between the lower and upper pressure value is referred to as the pressure band.

Two pressure bands are available. These are referred to as "p1" and "p2":

- "p1" is the normal pressure band that is used as standard.
- "p2" is a second pressure band that can be used if a different line pressure is required.

Pressure bands for compressors with speed control (RS)

With RS compressors the controller regulates the motor speed so that it is precisely matched to the compressed air requirement.

There are two pressure settings:

- Upper pressure value ("p1 Cut-Out Point" / "p2 Cut-Out Point"). The upper pressure value is the pressure at which the compressor will stop delivering air and go off-load.
- Lower pressure value ("p1 Target Pressure" / "p2 Target Pressure"). The lower pressure value is the pressure above which the compressed air network should be maintained.

For example:

- p1 Cut-Out Point: 10.0 bar
- p1 Target Pressure: 9.5 bar

To maintain the p1 Target Pressure of 9.5 bar, the compressor speed varies between the minimum and maximum.

Once the line pressure reaches the upper pressure value of 10.0 bar, the compressor switches to off-load, the run-on timer is activated and the compressor is placed in standby mode once the run-on timer has counted down.

Setting pressure band p1 for compressors with speed control (RS)

1 Tap the <Settings> tab.

– The menu "Settings" appears.

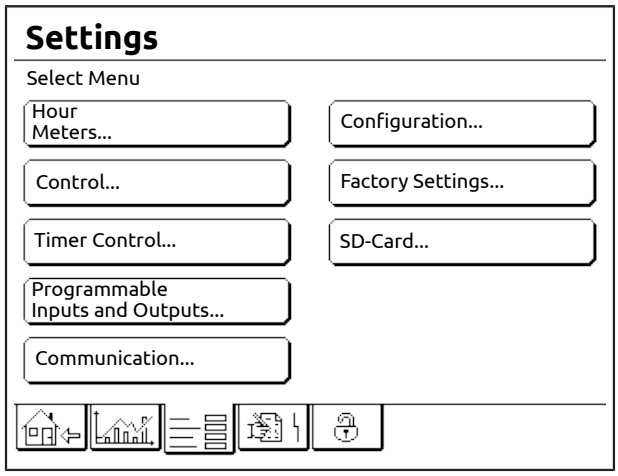


Fig. 5-14: Menu "Settings"

2 Tap the <Control...> button.

– The menu "Control" appears.

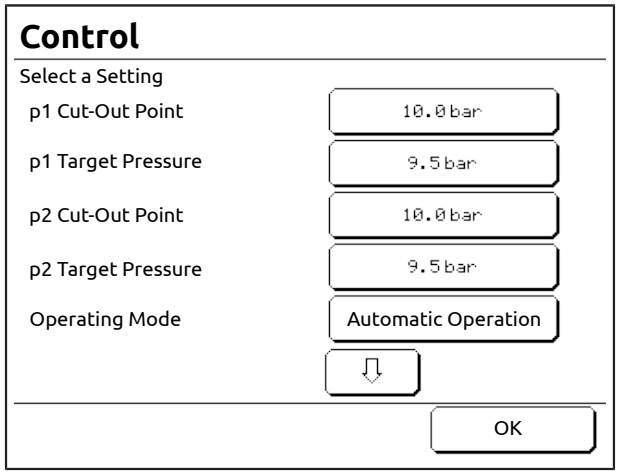


*Fig. 5-15: Menu "Control" (**RS**)*

3 Tap the button <p1 Target Pressure>.

– The input menu "p1 Target Pressure" appears.

4 Tap the <Number buttons> to enter the pressure value.

The <Cancel> button can be used to cancel setting of the pressure value.
The previously active pressure value is used.

5 Tap the <OK> button.

– The set pressure value is saved.

– The display reverts to the previous menu, "Control".

6 Tap the button <p1 Cut-Out Point>.

– The input menu "p1 Cut-Out Point" appears.

7 Tap the <Number buttons> to enter the pressure value.

NOTE

The difference between the upper and lower pressure value must not be less than 0.3 bar (interlock).

The difference between the upper and lower pressure value should not be less than 0.5 bar (recommendation).

The <Cancel> button can be used to cancel setting of the pressure value.
The previously active pressure value is used.

8 Tap the <OK> button.

– The set pressure value is saved.

– The display reverts to the previous menu, "Control".

✓ The pressure band p1 is set.

Setting pressure band p2 for compressors with speed control (RS)

Setting of pressure band p2 takes place as previously described, the sole difference is that the p2 buttons must be tapped rather than the p1 buttons.

Pressure bands for fixed speed compressors (FS)

With FS compressors the suction regulator regulates the on-load / off-load control in order to provide the required compressed air quantity.

There are two pressure settings:

- Upper pressure value ("p1 Cut-Out Point" / "p2 Cut-Out Point"). The upper pressure value is the pressure at which the compressor will go off-load.
- Lower pressure value ("p1 Cut-In Point" / "p2 Cut-In Point"). The lower pressure value is the pressure at which the compressor will go on-load.

For example:

- p1 Cut-Out Point: 10.0 bar
- p1 Cut-In Point: 9.5 bar

The compressor switches between on-load and off-load, to maintain the line pressure within the two pressure values.

If the line pressure reaches the upper pressure value of 10 bar, the suction regulator closes and the compressor switches to off-load so that it ceases to supply compressed air. The run-on timer is activated and the compressor is switched to standby after the run-on time has elapsed.

If the line pressure reaches the lower pressure value of 9.5 bar(Pressure Demand), the suction regulator opens and the compressor switches on-load so that it is again supplying compressed air.

Setting pressure band p1 for fixed speed compressors (FS)

1 Tap the <Settings> tab.
   – The menu "Settings" appears.
2 Tap the <Control...> button.
   – The menu "Control" appears.
3 Tap the button <p1 Cut-In Point>.
   – The input menu "p1 Cut-In Point" appears.
4 Tap the <Number buttons> to enter the pressure value.
   The <Cancel> button can be used to cancel setting of the pressure value. The previously active pressure value is used.
5 Tap the <OK> button.
   – The set pressure value is saved.
   – The display reverts to the previous menu, "Control".
6 Tap the button <p1 Cut-Out Point>.
   – The input menu "p1 Cut-Out Point" appears.
7 Tap the <Number buttons> to enter the pressure value.
   The <Cancel> button can be used to cancel setting of the pressure value. The previously active pressure value is used.
8 Tap the <OK> button.
   – The set pressure value is saved.
   – The display reverts to the previous menu, "Control".

✓ The pressure band p1 is set.

Setting pressure band p2 for fixed speed compressors (FS)

Setting of pressure band p2 takes place as previously described, the sole difference is that the p2 buttons must be tapped rather than the p1 buttons.

Specifying the source for pressure band control

The source for pressure band control can be changed via p2 timer control operation as well as via the programmable inputs. See chapter "Configuration / Timer Control Operation" and chapter "Configuration / Inputs and Outputs".

5.5.2 Programming Inputs and Outputs

NOTICE

Material damage

⇨ Only potential-free contacts may be connected to the terminal strip.
External voltages result in destruction of the controller.

⇨ The potential-free contacts must not be more than 20 metres away from the terminal strip.
If necessary, coupling relays must be fitted in the switch cabinet.

5.5.2.1 Programmable Inputs

The controller has programmable inputs. The number of inputs may vary depending on the compressor configuration. See wiring diagram.

NOTE

Programmable inputs may already be occupied by pre-installed accessories and/or optional equipment. Which inputs are free can be determined using the supplied wiring diagram.

If monitoring equipment has been pre-installed and connected to programmable inputs, you must not change the corresponding settings, as doing so would disable the monitoring equipment.

Inputs can be assigned to

- monitor conditions or devices when the contacts on the appropriate terminals are opened.
- to activate functions when the contacts on the appropriate terminals are closed.

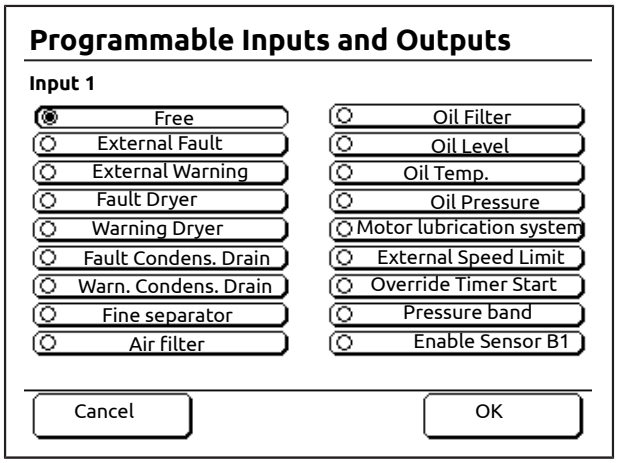


*Fig. 5-16: Menu "Programmable Inputs and Outputs" for input 1 (**RS**)*

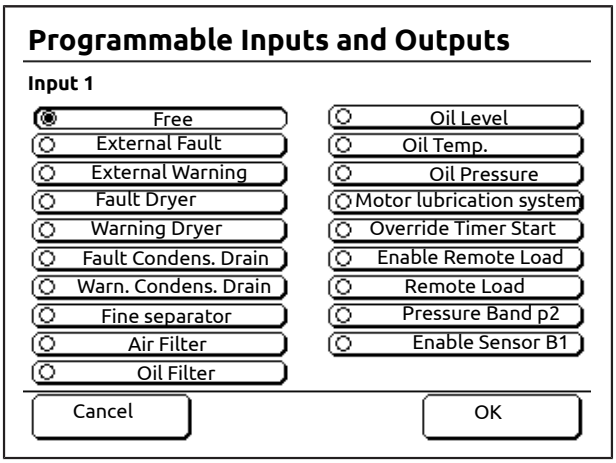


*Fig. 5-17: Menu "Programmable Inputs and Outputs" for input 1 (**FS**)*

The options described below may be assigned to the programmable inputs.

NOTE

Wenn ein programmierbarer Eingang aktiviert wird, d. h. elektrisch geschlossen wird, dem Eingang jedoch keine Überwachung oder Funktion zugewiesen ist, wird auf dem Display die Meldung "Input x" angezeigt.

Siehe Warnungen A617-A622 im Kapitel "Störungsbeseitigung".

Free

No function is assigned to the input.

External Fault

If the device connected to the input sends a control signal (contact open upon fault), the message "E412:External Fault" is displayed. The compressor is switched off. Sample application: Important device in the customer compressed air network (e.g. a sensor in the downstream, site compressed air treatment equipment signals a fault).

See the operating instructions for the connected device.

External Warning

If the device connected to the input sends a control signal (contact open upon fault), the message "A615:External Warning" is displayed. The compressor is not switched off. Sample application: Important device in the customer compressed air network (e.g. a sensor in the downstream, site compressed air treatment equipment signals a fault).

See the operating instructions for the connected device.

Fault Dryer

If the dryer connected to the input sends a fault message (contact open upon fault), the message "E413:Dryer" is displayed. The compressor is switched off.

See operating instructions for the dryer.

Warning Dryer

If the dryer connected to the input sends a warning (contact open upon fault), the message "A608:Dryer" is displayed. The compressor is not switched off.

See operating instructions for the dryer.

Fault Condens. Drain

If the condensate drain connected to the input sends a fault message (contact open upon fault), the message "E414:Extern. Condensate Drain" is displayed. The compressor is switched off.

See operating instructions for the condensate drain.

Warn. Condens. Drain

If the condensate drain connected to the input sends a warning (contact open upon fault), the message "A609:Extern. Condensate Drain" is displayed. The compressor is not switched off.

See operating instructions for the condensate drain.

External Speed Limit (RS)

This function can be used to temporarily limit the lower and upper speed of the drive motor, e.g. if it necessary to limit the maximum delivered air quantity/power consumption.

Fine separator

This optional monitoring feature can be set to display a warning "A610:Air Filter" if the fine separator's differential pressure switch indicates that the fine separator needs to be replaced.

Air Filter

This optional monitoring feature can be set to display a warning "A611:Air Filter" if the air filter's differential pressure switch indicates that the air filter needs to be replaced.

Oil Filter

This optional monitoring feature can be set to display a warning "A612:Oil Filter" if the oil filter's differential pressure switch indicates that the oil filter needs to be replaced.

Oil Level

Combined with a level switch this function checks the oil level during the on-load phase. Too low an oil level generates the warning "A613:Oil level low".

Oil Temp.

Opening this optional switch contact causes a warning "A614:Oil temperature high" to be output.

Oil Pressure

If a too low pressure switches the pressure switch connected at the input (contact open upon fault), the message "E411:Oil Pressure Low" is displayed. The compressor is switched off.

Motor lubrication system (if equipped with an automatic motor lubrication system)

This option can be set to monitor the operation of automatic motor greasing units. Warning "A616411:Motor lubrication system" is displayed if the grease packing is used up or another fault exists.

Configuring the function "External Speed Limit" (RPM Limit)

1 Set the desired min/max values in the "Settings / Configuration" menu.

2 Allocate an input to this function. See chapter "Input programming".

As soon as the input is connected, the drive motor speed only moves within the desired band.

Override Timer Start

If the compressor has been switched off because of settings in the menu "Timer Start/Stop" (see chapter "Timer control operation"), this function will override the timer and start the compressor as long as the input is activated.

For example, this allows the compressor to be started by maintenance personnel during a weekend when the timer would normally have shut down the compressor.

Pressure Band p2

This function switches the pressure band to pressure band p2.

If this function is active, the menu "Home" (field "Current Pressure Band") indicates that the pressure band p2 is being used and has been activated by a programmable input. The programmable input number is also displayed.

Enable Sensor B1

Ex works, the signal for switching the compressor between on-load and off-load is generated by the compressed air line pressure sensor B1.

If the input is open, the compressor switches to off-load. If the input is closed, the sensor again controls switching of the compressor between on-load and off-load.

Enable Remote Load (FS)

If the input is connected, on-load/off-load control takes place solely via the "Remote Load" function described below.

Remote Load (FS)

The Remote Load and Off-Load function makes it possible to remotely switch an FS compressor, e.g. from a control room, off and on-load. Condition: "Enable Remote Load" is activated.

See chapter "Configuration / Remote load and off-load (FS)".

5.5.2.2 Conditions Associated With Programmable Inputs

The following table contains a list of conditions that must be fulfilled before the controller triggers the allocated event.

Monitoring	Condition
External Fault	Time >1 s
External Warning	Time >1 s
Fault Dryer	Time >1 s
Warning Dryer	Time >1 s
Fault Condens. Drain.	Line pressure > 1.0 bar and time > 250 s
Warn. Condens. Drain	Line pressure > 1.0 bar and time > 250 s
Fine separator	Time >30 s
Air Filter	Time >30 s
Oil Filter	Time >30 s
Oil Level	Time > 60 s (only during on-load phase)
Oil Temp.	Time >30 s
Oil Pressure	Time > 30 s (only during on-load phase)

Chart 5-1: Conditions Associated With Programmable Inputs

5.5.2.3 Input programming

1 Tap the <Settings> tab.
   – The menu "Settings" appears.
2 Tap the <Programmable Inputs and Outputs> button.
   – The menu "Programmable Inputs and Outputs" appears.

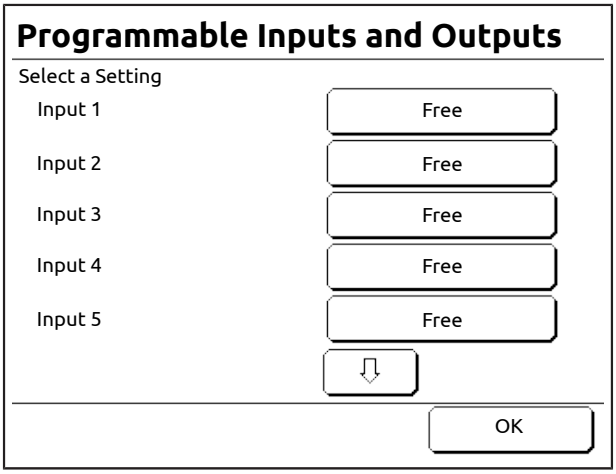


Fig. 5-18: Menu "Programmable Inputs and Outputs"

3 Tap the <Input x> button of the desired input.
   – The menu "Programmable Inputs and Outputs" appears for the desired input.

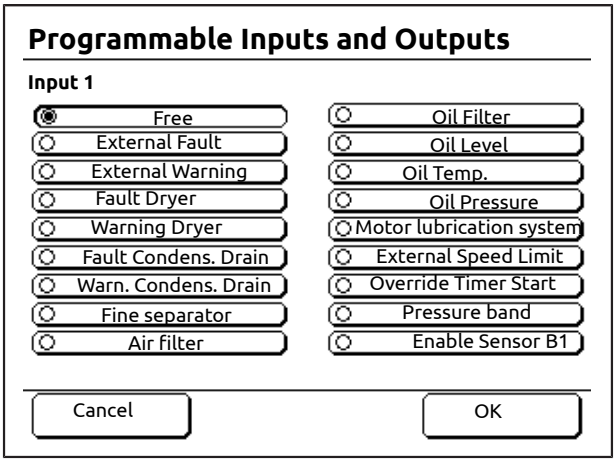


*Fig. 5-19: Menu "Programmable Inputs and Outputs" for input 1 (e.g. **RS**)*

4 Tap the <Button> for the desired input function.
   The <Cancel> button can be used to cancel selection of the input function. The function previously allocated to the input can be used.
5 Tap the <OK> button.

✓ The input is programmed.

The other free inputs can be programmed in a similar way.

5.5.2.4 Programmable outputs

The controller has programmable outputs. The number of outputs may vary depending on the compressor configuration. See wiring diagram.

NOTE

Programmable outputs may already be occupied by pre-installed accessories and/or optional equipment. Which outputs are free can be determined using the supplied wiring diagram.

Outputs can be assigned to

- Activating of functions or devices (e.g. warning lamps in a control centre) if the appropriate output terminals are closed.

NOTICE

Material damage

⇨ Max. current / max. voltage per relay output: 1A at 240V.

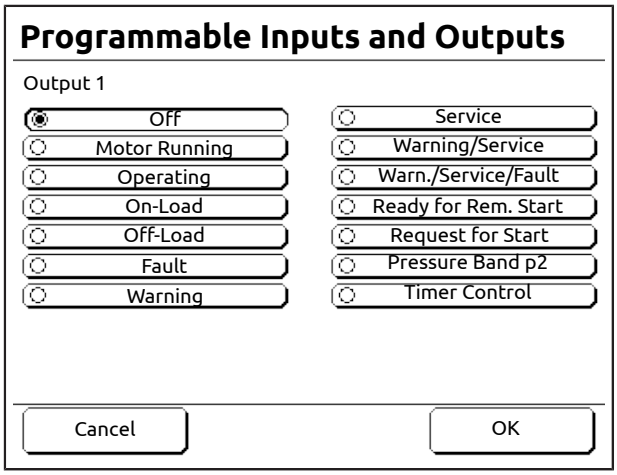


Fig. 5-20: Menu "Programmable Inputs and Outputs" for input 1

Off

The output remains permanently deactivated.

Motor Running

The output is activated if the drive motor is running.

Operating

The output is activated whenever the compressor is operating (on-load, off-load or standby).

On-Load

The output is activated if the compressor is on-load.

Off-Load

The output is activated if the compressor is off-load.

Fault

The output is activated as long as no fault exists. The output is deactivated if a fault has arisen.

Warning

The output is activated as long as no warning exists. The output is deactivated if a warning is triggered.

Maintenance

The output is activated as long as no service is due. The output is deactivated when a service is due or overdue. This is triggered within 200 hours of the next service being due.

Warning/Service

The output is activated as long as no warning exists or service is due. The output is deactivated when a warning occurs or a service is due (combined message).

Warn. / Service / Fault

The output is activated as long as no warning or fault exists or service is due. The output is deactivated when a warning or fault occurs or a service is due (combined message).

Ready for Rem. Start

The output is activated if the controller has been programmed to remote start and all conditions for a remote start are fulfilled.

Request for Start

The output is activated, if the compressor wants to start and is expecting a "Start Requ. Approval" over an appropriate input.

Pressure Band p2

Indicates that the controller is currently using pressure band p2.

Pressure band p2 is either activated by the p2 timer control or a programmable input.

Timer Control

Indicates that "Timer Control Enabled" is switched on and an enablement of the timer control timetable exists. The compressor runs if it is in the time window and is switched ON.

5.5.2.5 Output programming

1 Tap the <Settings> tab.
   – The menu "Settings" appears.

2 Tap button <Programmable Inputs and Outputs>.
   – The menu "Programmable Inputs and Outputs" appears.

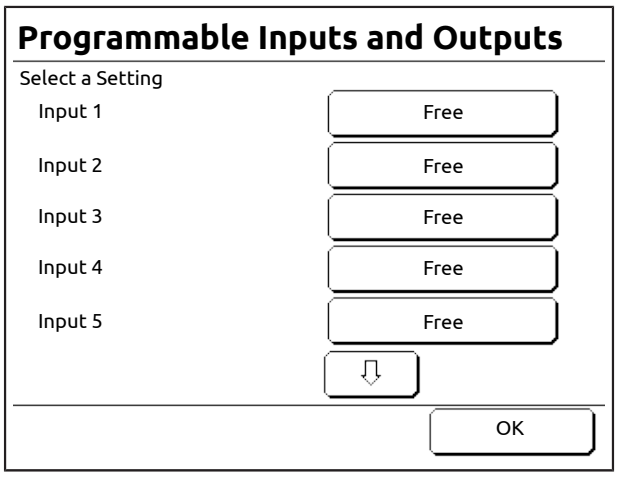


Fig. 5-21: Menu "Programmable Inputs and Outputs"

3 <Tap the < arrow keys>, until the desired output appears.

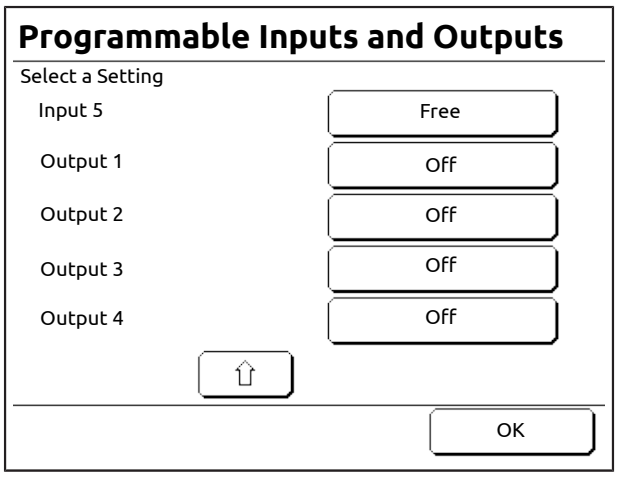


Fig. 5-22: Menu "Programmable Inputs and Outputs"

4 Tap the button <Output x> of the desired output.
   – The menu "Programmable Inputs and Outputs" appears for the desired output.

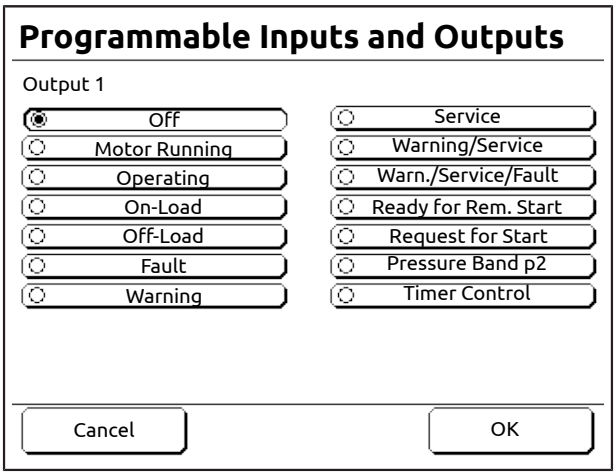


Fig. 5-23: Menu "Programmable Inputs and Outputs" for input 1

5 Tap the <Button> for the desired output function.

The <Cancel> button can be used to cancel selection of the output function. The function previously allocated to the output can be used.

6 Tap the <OK> button.

✓ The output is programmed.

The other free outputs can be programmed in a similar way.

5.5.3 Timer control operation

5.5.3.1 Timer-Controlled Starting and Stopping

The controller can be programmed to automatically start and stop the compressor at pre-determined times of the day or night, seven days a week.

Three steps are necessary to do this:

1. Define switching on and off times.

2. Grant the enablement for timer control operation in the menu "Controls".

3. Press the start key < I > (turn the compressor on).

Example

A factory might work a 2-shift system where the morning shift starts at 8 am (08:00) and finishes at 4 pm (16:00).

An evening shift might then start at 5 pm (17:00) and finish at 1 am (01:00).

5 day working week; there is no weekend work.

The controller is programmed as follows for this:

- The compressor starts at 07:50 a.m.
- The compressor stops at 16:10 p.m.
- The compressor starts at 16:50 a.m.
- The compressor stops at 01:10 p.m.

5.5.3.2 Setting the start and stop times of the compressor

The setting of the compressor start and stop times is described using the previous example.

1 Tap the <Settings> tab.

– The menu "Settings" appears.

2 Tap the <Timer Control...> button.

– The menu "Timer Control" appears.

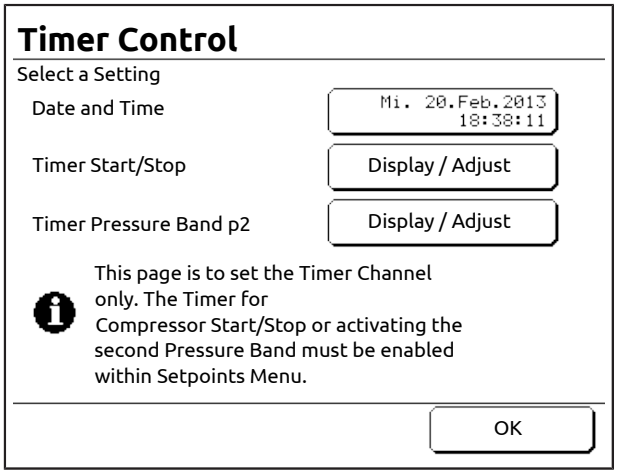


Fig. 5-24: Menu "Timer Control"

3 Tap button <Timer Start/Stop>.

– The menu "Timer Start/Stop" appears.

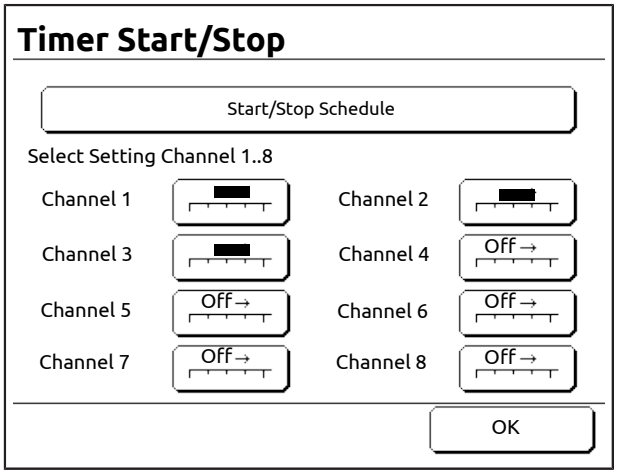


Fig. 5-25: Menu "Timer Start/Stop" (condition after programming)

The menu shows the overview of the timer control channels.
Each timer channel controls one compressor start time and one compressor stop time and enables them to be applied to one or more days of the week.

Program the compressor for the morning shift

1 Tap button <Channel 1>.
   – The input menu for setting start time, end time and weekday appears.

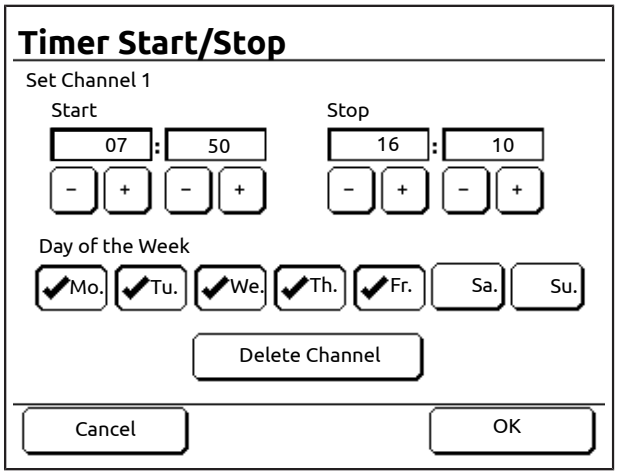


Fig. 5-26: Input menu "Timer Start/Stop" for timer control channel 1 (condition after programming)

2 Press buttons <+> and <-> to set the start and end times.

3 Tap button <Day of the Week>, to specify the weekdays on which the time setting should become effective.

   Button <Delete Channel> causes all entries to be discarded.

   Data entry is cancelled by tapping the button <Cancel>. The functionality previously allocated to the timer control channel is used.

4 Tap the <OK> button.
   – The entries are saved.
   – The menu "Timer Start/Stop" appears.

Programming the compressor for the late shift

1 Tap button <Channel 2>.
   – The input menu for setting start time, end time and weekday appears.

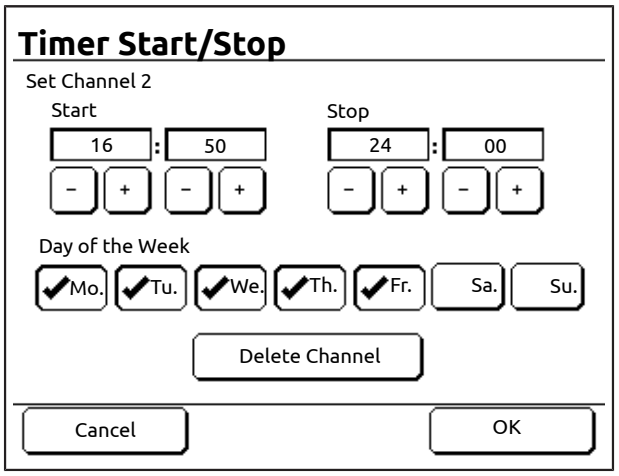


Fig. 5-27: Input menu "Timer Start/Stop" for timer control channel 2 (condition after programming)

2 Press buttons <+> and <-> to set the start and end times.

3 Tap button <Day of the Week>, to specify the weekdays on which the time setting should become effective.

   Button <Delete Channel> causes all entries to be discarded.

   Data entry is cancelled by tapping the button <Cancel>. The functionality previously allocated to the timer control channel is used.

4 Tap the <OK> button.
   – The entries are saved.
   – The menu "Timer Start/Stop" appears.

Programming additionally required timer control channels

Each timer control channel can only cover a range from 00:00 to 24:00. An additional timer control channel is required for the period from 00:00 to 01:10.

1 Tap button <Channel 3>.
   – The input menu for setting start time, end time and weekday appears.

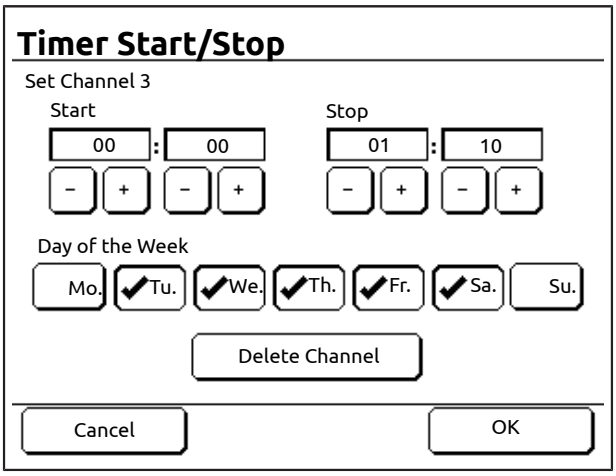


Fig. 5-28: Input menu "Timer Start/Stop" for timer control channel 3 (condition after programming)

2 Press buttons <+> and <-> to set the start and end times.

3 Tap button <Day of the Week>, to specify the weekdays on which the time setting should become effective.

Button <Delete Channel> causes all entries to be discarded.

Data entry is cancelled by tapping the button <Cancel>. The functionality previously allocated to the timer control channel is used.

4 Tap the <OK> button.

– The entries are saved.

– The menu "Timer Start/Stop" appears.

Start/Stop Schedule

The summary screen "Start/Stop Schedule" makes it possible to graphically summarise the settings made.

1 Tap the <Settings> tab.

2 Tap the <Timer Control...> button.

3 Tap button <Timer Start/Stop>.

4 Tap button <Start/Stop Schedule>.

– The screen "Start/Stop Schedule" appears.

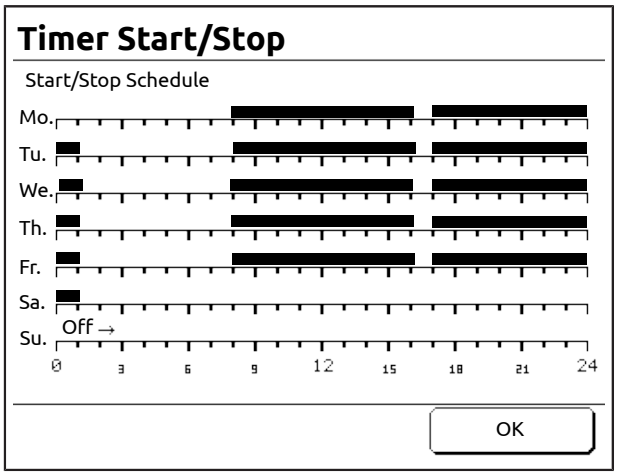


Fig. 5-29: Summary of the timer control channel settings (condition after programming)

The summary screen "Start/Stop Schedule" shows the hours of each day between 0:00 and 24:00 along the X-axis and the days of the week along the Y-axis. The highlighted areas show the timer channels which have been programmed (time windows).

5.5.3.3 Activating timer control operation

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Tap the <arrow keys> until the button <Timer Control Enabled> is visible.

4 Tap the button <Timer Control Enabled>.

– The menu "Timer Control Enabled" appears.

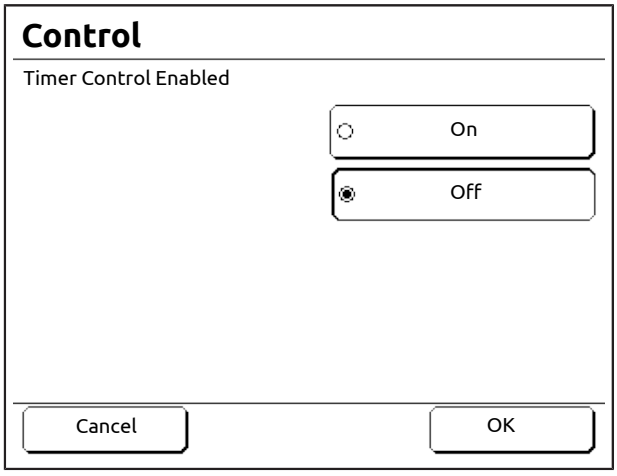


Fig. 5-30: Menu "Timer Control Enabled"

5 Press button <On>.

The <Cancel> button can be used to cancel enabling of timer control operation. The previously active setting is used.

6 Tap the <OK> button.

✓ Timer control operation is activated.

– The menu "Home" indicates that "Timer Control Enabled" is activated.

Tapping the button <Off> in the menu "Timer Control Enabled" causes timer control to be deactivated again.

7 Press the start button < I >.

– The compressor is switched ON (placed in operation).

– The compressor runs if it is in the time window.

5.5.3.4 Setting the timer control for operation in pressure band p2

Time-controlled switching to the second pressure band can be implemented via "Timer Pressure Band p2".

Example

As an alternative to the example used above, reduced pressure is to be maintained, instead of completely shutting down the compressor, between 16:10 (4.10 pm) and 16:50 (4.50 pm). The p2 timer would be set up as follows:

Programming the second pressure band

1 Tap the <Settings> tab.

– The menu "Settings" appears.

2 Tap the <Timer Control...> button.

– The menu "Timer Control" appears.

3 Tap button <Timer Pressure Band p2>.

– The menu "Timer Pressure Band p2" appears.

4 Tap button <Channel 1>.

– The input menu for setting start time, end time and weekday appears.

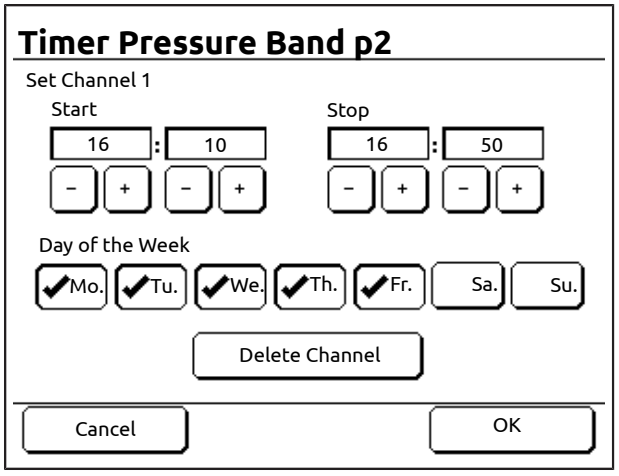


Fig. 5-31: Input menu "Timer Pressure Band p2" for timer control channel 1 (condition after programming)

5 Press buttons <+> and <-> to set the start and end times.

6 Tap button <Day of the Week>, to specify the weekdays on which the time setting should become effective.

Button <Delete Channel> causes all entries to be discarded.

Data entry is cancelled by tapping the button <Cancel>. The functionality previously allocated to the timer control channel is used.

7 Tap the <OK> button.

– The entries are saved.

– The menu "Timer Start/Stop" appears.

8 Tap the <OK> button.

✓ The timer control is programmed for the example.

– The on times are saved.

– The menu "Timer Start/Stop" appears with the confirmed entries.

p2 Pressure Band Schedule

1 Tap the <Settings> tab.

2 Tap the <Timer Control...> button.

3 Tap button <Timer Pressure Band p2>.

4 Tap button <p2 Pressure Band Schedule>.

– The screen "p2 Pressure Band Schedule" appears.

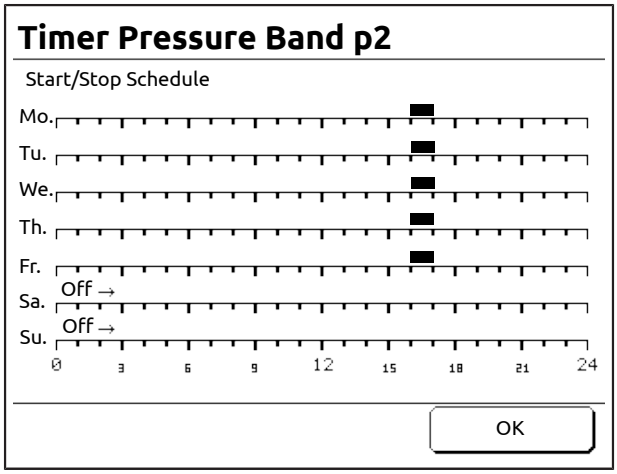


Fig. 5-32: Summary of the timer control channel settings (condition after programming)

Along the X-axis, the overview shows the hours of each day between 0:00 and 24:00 and the days of the week along the Y-axis. The highlighted areas show the timer channels which have been programmed (time windows).

5.5.3.5 Activating the timer control for operation in pressure band p2

Activating Timer Pressure Band p2

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Tap the <arrow keys> until the button <p2 Timer Enabled> is visible.

4 Tap the button <p2 Timer Enabled>.

– The menu "p2 Timer Control Enabled" appears.

5 Tap button <On>.

The <Cancel> button can be used to cancel enabling of timer control operation. The previously active setting is used.

6 Tap the <OK> button.

✓ Timer control for pressure band p2 is activated.

– The menu "Control" appears.

– "On" is now displayed on the button <p2 Timer Enabled>.

– Likewise it is indicated in the menu "Home" that the p2 timer control is activated (if in the time window).

Tapping the button <Off> in the menu "p2 Timer Enabled" causes p2 timer control to be deactivated again.

7 Press the start button < I >.

– The compressor is switched ON (placed in operation).

– The compressor runs in pressure band p2, if it is in the p2 time window and the p2 conditions are fulfilled.

p2 conditions

The compressor will always revert to the p1 pressure band by default unless:

- a scheduled p2 event is currently active (in the time window) and
- the p2 timer control has been activated in the "Control" menu.

If both of these conditions are fulfilled, the controller switches to pressure band p2.

5.5.4 Programming dryer pre-run time

The controller can be programmed so that the compressor is only started after a certain lead time, whether during manual or remote starting. In this way an external dryer can reach its optimum operating temperature.

The minimum pre-run time is detailed in the dryer operating instructions.

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Tap the <arrow keys> until the button <Dryer Pre-Run Time> is visible.

4 Tap button <Dryer Pre-Run Time>.

– The input menu for the dryer pre-run time appears.

5 Tap the <Number buttons> to enter the required dryer pre-run time.

Data entry can be cancelled by tapping the button <Cancel>. The previously active input value is used.

6 Tap the <OK> button.

✓ The dryer pre-run time is programmed.

– The menu "Control" appears.

– The set time is now displayed on the button <Dryer Pre-Run Time.

Programming the programmable output to start the external dryer

1 Tap the <Settings> tab.

2 Tap tab <Programmable Inputs and Outputs>.

3 Tap button <Output x> for the output to which the external dryer is connected.

4 Tap button <Operating>.

The <Cancel> button can be used to cancel the allocation of the output. The previously active setting is used.

5 Tap the <OK> button.

✓ The programmable output for starting the external dryer is programmed.

Operating behaviour of dryer and compressor

The external dryer is switched on if the compressor is operating.

The external dryer is switched off if the compressor is not operating.

- Press the start button < I >.
- The relay output closes.
  – The dryer connected to the relay output is switched on and running.
  – Starting of the compressor is delayed by the set dryer pre-run time.
- The compressor starts after the dryer pre-run time has elapsed.
- Operation; compressor and dryer running.
- Press stop button< O >.
  – The compressor is stopped.

- The relay output opens.
  - The dryer connected to the relay output is switched off.

5.5.5 Configuring RS484 communication

RS485 communication

The controller has a serial RS485 interface (designation "RS485:1"). A second RS485 interface is optionally available (designation "RS485:3"). The RS485 interfaces use the Modbus RTU protocol.

The RS485 interface can be used to communicate with external sequencers or for monitoring purposes.

Configuring the RS485 interface

1 Tap the <Settings> tab.

2 Tap the <Communication...> button.
  - The menu "Communication" appears.

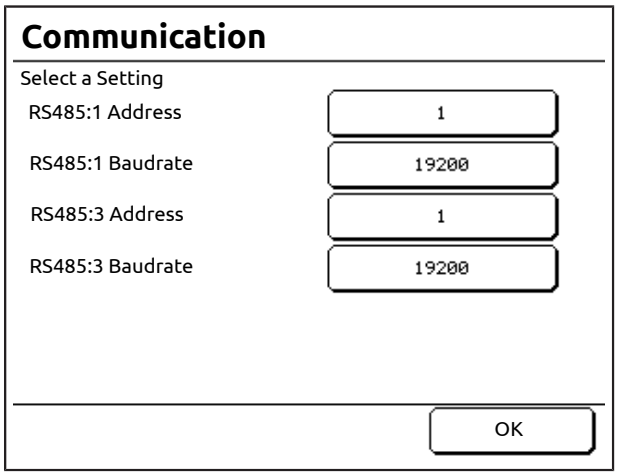


Fig. 5-33: Menu "Communication"

The following menu options are available.

- Set address
- Set baudrate

Set address

1 Tap button <Address>.
  - The input menu for setting the address appears.

2 Tap the <Number buttons> to enter the interface address.

  Address entry can be cancelled by tapping the button <Cancel>. The previously active setting is used.

3 Tap the <OK> button.

✓ The address is set.
  - The menu "Communication" appears.

Set baudrate

1 Tap button <Baudrate>.
  - The input menu for setting the baudrate appears.

2 Tap the <Baudrate> button for the desired value.

  Baudrate entry can be cancelled by tapping the button <Cancel>. The previously active setting is used.

3 Tap the <OK> button.

✓ The baudrate is set.
  - The menu "Communication" appears.

5.5.6 Setting automatic restart after a power failure

⚠ DANGER

In this operating mode, the compressor may start up automatically at any time.

⇨ Provide the compressor with warning signs.

⇨ Keep the compressor room locked.

⇨ Instruct personnel.

⇨ Install the main switch according to EN 60204 and attach a warning sign to it.

5.5.6.1 Automatic re-start

The controller can be set so that the compressor automatically restarts after a power failure.

The permissible duration of a power failure can be set. If the duration of the power failures exceeds the set time, the compressor will not restart automatically. The fault message "E400:Power Supply Failure" appears in the display. In this case the compressor must be manually started.

If the compressed air station comprises several compressors, setting of start delay allows a staggered start-up.

Activating automatic restart

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Press the <arrow keys> until the <Automatic re-start> button appears.

4 Tap the <Automatic re-start> button.
  - The input menu "Automatic re-start" opens.

5 Tap the <On> button.

The <Cancel> button can be used to cancel enabling of the automatic restart. The previously active setting is used.

6 Tap the <OK> button.

✓ Automatic restart after a power failure is enabled.

– The "Control" menu appears.

– On the <Automatic re-start> button the text changes to "On".

– In the menu "Home" it is also indicated that automatic restart is enabled.

Tapping the button <Off> in the menu "Automatic re-start" causes automatic restart to be disabled again.

Setting the maximum power loss time

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Press the <arrow keys> until the <- Max. Power Loss Time> button appears.

4 Tap the <- Max. Power Loss Time> button.

– The input menu "- Max. Power Loss Time" opens.

5 Tap the <arrow keys> to set the desired maximum power loss time.

The <Cancel> button can be used to cancel setting of the maximum power loss time. The previously active setting is used.

6 Tap the <OK> button.

✓ The maximum power loss time is set.

– The "Control" menu appears.

– The set power loss time is now displayed on the button <- Max. Power Loss Time>.

NOTE

The power loss time can be set to "unlimited". This is not permissible in some countries. Contact Gardner Denver for advice.

DANGER

Danger to life and limb.

In this operating mode, the compressor may start automatically at any time and for an unlimited duration after a power loss.

⇨ To enable this operating mode, a code must be requested from Gardner Denver.

⇨ The country of installation must always be specified with the request.

⇨ Before the compressor can be operated in this operating mode, all applicable safety instructions must be fulfilled and all necessary safety equipment installed.

Start delay

If a compressed air station comprises several compressors and, upon reconnection of the power supply, all the compressors were to restart simultaneously, overloading/failure of the power supply could occur. A staggered start can be configured if individually different start delay times are set, which results in a more uniform power consumption.

Setting a start delay

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Press the <arrow keys> until the <- Restart Delay> button appears.

4 Tap the <- Restart Delay> button.

– The input mask "- Restart Delay" opens.

5 Tap the <arrow keys> to set the desired maximum restart delay time.

The <Cancel> button can be used to cancel setting of the restart delay time. The previously active setting is used.

6 Tap the <OK> button.

✓ The start delay is set.

– The "Control" menu appears.

– The set restart delay time is now displayed on the button <- Restart Delay>.

5.5.7 Setting Remote Start and Stop

⚠ DANGER

In this operating mode, the compressor may start up automatically at any time.

⇨ Provide the compressor with warning signs.

⇨ Keep the compressor room locked.

⇨ Instruct personnel.

⇨ Install the main switch according to EN 60204 and attach a warning sign to it.

NOTICE

Material damage

⇨ Only potential-free contacts may be connected to the terminal strip.
External voltages result in destruction of the controller.

⇨ The potential-free contacts must not be more than 20 metres away from the terminal strip.
If necessary, coupling relays must be fitted in the switch cabinet.

The function "Remote Start/Stop" makes it possible to start or stop the compressor remotely, e.g. from a control room.

This function is permanently programmed and has its own dedicated terminals (see circuit diagram).

As long as the potential-free contact is closed, the compressor continues running. If the contact is opened, a soft stop occurs and the compressor stops.

Activating the "Remote Start/Stop" function

⚠ DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

⇨ With the speed-controlled types (**ARV**) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage. (**Only applicable for Allen Bradley frequency converter**)

1 Connect the potential-free contact, which is required for the function "Remote Start/Stop" to the appropriate terminals (see wiring diagram). This input is permanently programmed for the "Remote Start / Stop" function.

2 Tap the <Settings> tab.

3 Tap the <Control...> button.

4 Press the <arrow keys> until the <Remote Start Enabled> button appears.

5 Tap the button <Remote Start Enabled>.

– The input mask "Remote Start Enabled" appears.

6 Tap button <On>.

The <Cancel> button can be used to cancel enabling of the remote start function. The previously active setting is used.

7 Tap the <OK> button.

✓ The function "Remote Start/Stop" is enabled.

– The menu "Control" appears.

– "On" is now displayed on the button <Remote Start Enabled>.

– Likewise it is indicated in the menu "Home" that the function "Remote Start/Stop" is enabled.

– The message "Attention:Start by Remote Control..." appears on the display

Now the compressor can only be switched on and off via the potential-free contact. The start and stop buttons on the control panel no longer function, the <emergency-stop> button still functions.

Tapping the button <Off> in the menu "Remote Start Enabled" allows the function "Remote Start/ Stop" to be deactivated again.

Remote start function after a power failure

After a power failure the remote switch must be switched OFF and then ON again so that the compressor starts.

If an automatic restart is desired after a power failure, this function must be activated accordingly (see chapter "Setting automatic restart after a power failure") and the remote switch must still be set to "ON" when the power supply comes back on line.

5.5.8 Remote Load and Off-Load (FS)

This function makes it possible to remotely switch an FS compressor, e.g. from a control room, off and on-load.

⚠ DANGER

In this operating mode, the compressor may start up automatically at any time.

⇨ Provide the compressor with warning signs.

⇨ Keep the compressor room locked.

⇨ Instruct personnel.

⇨ Install the main switch according to EN 60204 and attach a warning sign to it.

NOTICE

Material damage

⇨ Only potential-free contacts may be connected to the terminal strip.
External voltages result in destruction of the controller.

⇨ The potential-free contacts must not be more than 20 metres away from the terminal strip.
If necessary, coupling relays must be fitted in the switch cabinet.

Activating the function "Remote Load and Off-Load"

1 Tap the <Settings> tab.

2 Tap the <Programmable Inputs and Outputs...> button.

3 Program a free input to "Enable Remote Load".

4 Program a further free input to "Remote Load".

As long as the function "Enable Remote Load" is activated, the on-load/off-load command can only be given via the remote load input. All internal pressure setpoints are ignored. If the line pressure exceeds the set compressor rated pressure due to a permanent remote load signal by more than 0.5 bar, "Warning A606:Line Pressure high" is displayed. As long as warning "A606" is active, the remote load input is deactivated.

6 OPERATIONS

6.1 Stopping the compressor in an emergency

Emergency-stop

The compressor can be rendered safe in dangerous situations using the emergency-stop pushbutton.

The emergency-stop button is attached to the compressor control panel.

Using emergency-stop

See the compressor operating instructions.

1 Press the <Emergency-stop> pushbutton.
The compressor is placed in a safe condition.

2 Rectify the fault that was the cause of the Emergency-stop.
See the "Troubleshooting" chapter.

3 Unlock the <Emergency-stop> pushbutton.

4 Set the compressor in operation.
See section "Commissioning after a fault" in the chapter "Commissioning and operation".

6.2 Starting the compressor

The display shows "Startbereit".

If a fault exists, it must be cleared and reset in the menu "Störspeicher". See the "Troubleshooting" chapter.

1 Press the start button < I >.
– The compressor starts insofar as the start is not blocked by the following factors.

The compressor runs automatically after Druckanforderung.

6.3 Start Inhibits

The following factors can block the start of the compressor.

No Pressure demand

If when the start button < I > is pressed while no Pressure demand exists, the compressor switches to standby mode. The green LED flashes and the message "Attention:Start upon pressure demand..." is displayed.

The compressor will start automatically when the lower pressure setting is reached.

The ambient temperature lies below the permissible minimum start temperature

If due to a low ambient temperature the airend has been too strongly cooled, the compressor cannot be started.

When the start button < I > is pressed, the fault message "E404:Start Temperature low" is displayed.

After raising the ambient temperature, the fault must be reset in the menu "Fault History".

Dryer pre-run

If the compressor controls an external dryer, the controller can be programmed so that the dryer is started before the compressor is started so that the external dryer has reached its optimum operating temperature before the compressor is started. This is the purpose of the dryer pre-run time.

As long as the dryer pre-run time is still running, the compressor remains on standby. The green LED flashes and the message "Attention:Starting in "x" min after Dryer Pre-Run Time..." is displayed.

This Compressor starts automatically as soon as the dryer pre-run time has elapsed.

Start by Remote Control

If the compressor is operated via a remote control, the controller waits for the start command from the remote control.

The message "Attention:Start by Remote Control..." is displayed.

The compressor can only be switched on and off via the potential-free contact.

Start with Timer Control

If the compressor is operated via a timer control, the controller waits for the start command from the timer control.

The green LED flashes and the message "Attention:Start by timer control on <Day of the Week> at <Time> ..." is displayed.

The compressor starts automatically according to the timer control setting.

Start by external start request approval

If a programmable input has been activated by the function "Start Requ. Approval", the controller waits for the external start request approval.

The green LED flashes and the message "Attention:Start after external start request approval..." is displayed.

The compressor starts automatically if the external start request approval has been granted (which must be granted via a corresponding, programmable input).

6.4 Operations

Variable speed (RS)

The controller regulates the drive motor speed to that it exactly matches the compressed air demand.

In the minimum permissible speed is reached, On-/Off-load control takes place.

On-/Off-load control

The required compressed air quantity is controlled by switching the suction regulator on and off (On-/Off-load control).

6.5 Operating Modes

The controller has two operating modes:

- Automatic operation
- Continuous operation

Automatic operation

In automatic operation, the drive motor starts and stops automatically dependent on the Pressure demand.

Once the line pressure reaches the upper pressure value, the controller switches the compressor off-load and starts the run on time.

If no Pressure demand exists by the end of the run-on time, the controller stops the compressor and changes to standby mode.

If the line pressure reaches the lower pressure value (Pressure demand), the controller restarts the compressor.

Continuous operation

In continuous operation, the drive motor runs continuously, i.e. if the compressor switches off-load, no run-on time starts and the drive motor is not switched off.

Changing operating mode

Ex works the compressor is set to Automatic operation as standard.

To change the operating mode:

1 Tap the <Settings> tab.

2 Tap the <Control...> button.

3 Tap the <Operating mode> button.

– The input menu "Operating mode" opens.

4 Tap the <Continuous operation> button.

The <Cancel> button can be used to cancel changing of the operating mode. The previously active setting is used.

5 Tap the <OK> button.

✓ The operating mode is changed to Continuous operation.

– The "Control" menu appears.

– On the <Operating mode> button the text changes to "Continuous operation".

The button <Automatic operation> in the "Operating mode" can be used to change the operating mode back to Automatic operation.

6.6 Stopping the compressor

1 Press stop button< O >.

– The compressor switches to off-load and the drive motor stops after 30 seconds delay (soft stop).

– The message "Stopping Procedure <x>s" is displayed. The remaining seconds until the drive motor is stopped are counted down to "0".

The display indicates "Ready to Start". The green LED is off.

6.7 Operational monitoring

During operation, the controller monitors the compressor condition. The operating condition is indicated on the display.

The following operating conditions are displayed:

- Warnings; the compressor is still running
- Faults; the compressor is stopped
- Power Failures

Warnings / warning messages

Warning messages are displayed, if a monitored parameter is exceeded, yet a compressor shutdown is not necessary.

For example, if the outlet temperature of the two airends reaches 110°C, a flashing warning symbol with a corresponding message appears on the display. The red LED and the symbol on the tab <Fault History> flash slowly, the compressor continues running.

If the problem has been cleared and the temperature falls, the warning message continues to be displayed, the warning symbol, the red LED and the symbol on the tab <Fault History> continue to flash until the warning has been reset. The warning can be reset independently of whether the compressor is stopped or running.

Faults / faults messages

Fault messages are displayed when a monitored parameter is exceeded by enough to warrant shutting down the compressor automatically for safety reasons or to prevent damage to the compressor.

If, for example, the outlet temperature of the airend exceeds the specified limit value, the controller switches the compressor off and a flashing fault symbol appears on the display with a corresponding message. The symbol on the <Fault History> tab flashes, the red LED flashes quickly.

The compressor can only be restarted if the cause of the fault is cleared and the fault has been reset.

Power Failures

A power failure must be acknowledged in the menu "Fault History" before the compressor can be restarted.

If the switch on function "Remote start" is activated, the remote start must be switched OFF and ON. This causes the fault to be acknowledged in the fault history and automatically reset.

If the function "Automatic re-start" is activated, the compressor starts automatically after the power supply comes back on line.
If, in addition to the function "Automatic re-start", the function "Remote start" is activated, the remote switch must be set to "ON" for an automatic restart to be possible.

7 TROUBLESHOOTING

If a fault or warning (alarm) occurs, this is output to the display as a message. Moreover LEDs, a symbol in the status/message area and the symbol on the "Fault History" tab all flash.

Alarm acknowledgement

After the cause of the alarm has been cleared, the alarm must be reset in the controller.

1 Clear the cause of the alarm.

2 Tap the <Fault History> tab.

– The menu "Fault History" appears.

3 Tap the <Reset> button.

✓ The alarm is reset.

– The flashing alarm symbol disappears.

– The symbol on theFault History> tab stops flashing.

Alarms that are still uncleared cannot be reset. The alarm symbol and the symbol on the <Fault History> tab continue to flash.

7.1 Troubleshooting check list

Loose connections or plugs, a faulty power supply or failure to observe information/instructions can give rise to a whole series of faults.

The following points must be observed to avoid faults.

- The supply voltage must be within the permissible limits.
- The control transformer must be set to the local rated voltage (see wiring diagram diagram).
- The control cabinet temperature must not exceed 50 °C.
- Retrospectively installed remote controls (potential-free contacts) must not be more than 20 metres away from the terminal strip.
  If necessary, coupling relays must be fitted in the switch cabinet.
- Before commissioning and after performing maintenance work, make sure that all connection screws are tight and that all plugs are firmly connected.
- Power supply cables must be of adequate cross-section. When rating the cable(s), therefore, pay attention to the cable-laying method, line length and cable temperatures to be expected.
- When retro-fitting switchgear, the control-power transformers must not, under any circumstances, be "tapped" as they could be overloaded.
- Do not connect additional switchgear or measuring equipment without the approval of Gardner Denver.
- Do not route measuring sensors outside the compressor.
- Only use original Gardner Denver spare parts.
- In the event of technical queries, have the following information to hand:
  – System type / factory number
  – Re-order ref.
  – Circuit diagram, drawing no. and ID no.
  – Information about operating conditions
  – Information on any accessories you have retrospectively installed (remote controls, etc.)
  – Information about other retrospective changes or add-ons
  – The fault number and precise description of the fault that has occurred

7.2 How the Fault and Warning Codes are Structured

Fault codes consist of a letter, a number, and a brief description of the error that has occurred (event).

Letters

The letter "A" indicates warnings.

The letters "E" and "F" indicate faults.

Number Range

Number range	refers To
000 ... 399	Frequency converter (RS-Compressors)
400 ... 495	Compressor
500 ... 531	Frequency converter (RS-Compressors)
600 ... 695	Compressor
700 ... 731	Frequency converter (RS-Compressors)
1000 ... 1399	Fan frequency converter (ARV)

Chart 7-1: Number ranges for fault and warning codes

7.3 Troubleshooting

Faults triggered by the frequency converter G1 (Allen Bradley) (F000 - F399) (RS)

Display	Possible Cause	Remedy
Fault inverter G1 Fxxx	The frequency converter (VSD) detected a fault with error number xxx that was not subsequently listed.	Contact Gardner Denver Service.
Fault inverter G1 F003 .. F004	VSD undervoltage.	Check the power supply. Check fuses, renew if necessary. Check main contactor (compressors with PowerFlex 400 VSD only). Check that all connecting terminals and plugs are tight; retighten if necessary.
Fault inverter G1 F007	Motor overload of the VSD.	Check the power supply. Check back-up fuses, renew if necessary. Check main contactor (compressors with PowerFlex 400 VSD only). Check that all connecting terminals and plugs are tight; retighten if necessary.
Fault inverter G1 F008	Frequency converter (VSD) overtemperature.	Check the cooling air inlet filter of the switch cabinet for dirt and renew if necessary. See the compressor operating instructions. Ensure that the through ventilation of the switch cabinet and the VSD fans are working correctly. Check VSD outlet and inlet for blockages in the cooling air supply and dirty cooler fins.
Fault inverter G1 F017	Single phase loss of the VSD.	Check the power supply. Check back-up fuses, renew if necessary. Check main contactor (compressors with PowerFlex 400 VSD only). Check that all connecting terminals and plugs are tight; retighten if necessary.
Fault inverter G1 F021	Output phase loss of the VSD.	Check wiring from VSD to drive motor. Check that all connecting terminals and plugs are tight; retighten if necessary. Check motor winding.

*Chart 7-2: Faults triggered by the frequency converter (Allen Bradley) (F000 - F399) (**RS**)*

Display	Possible Cause	Remedy
Fault inverter G1 F038 .. F040	Earth fault at the VSD output.	Check motor winding. Carry out insulation test.
Fault inverter G1 F041 .. F046	Short circuit at the VSD output.	Check motor winding. Carry out insulation test.
Fault inverter G1 F064	Frequency converter (VSD) overload.	Check the differential pressure of the fine separator. Check the oil level. Check the water content of the oil.

*Chart 7-2: Faults triggered by the frequency converter (Allen Bradley) (F000 - F399) (**RS**)*

Faults triggered by the frequency converter G1 (WEG) (F000 - F399) (RS)

Display	Possible Cause	Remedy
Fault inverter G1 Fxxx	The frequency converter (VSD) detected a fault with error number xxx that was not subsequently listed.	Contact Gardner Denver Service.
Fault inverter G1 F006	Phase fault at the input power supply of the converter.	Check fuses, renew if necessary Check that all connecting terminals are tight; retighten if necessary.
	Asymmetry of the input voltage > 5 %.	Check the power supply.
	Fault in the upstream switch circuit.	Contact Gardner Denver Service.
Fault inverter G1 F021	The input voltage is too low and the voltage of the DC bus has exceeded the permissible minimal value.	Check the power supply.
	Phase loss at the input power supply.	Check fuses, renew if necessary Check that all connecting terminals are tight; retighten if necessary.
	Failure in the upstream switch circuit.	Contact Gardner Denver Service.
Fault inverter G1 F022	The input voltage is too high and the voltage of the DC bus has exceeded the permissible highest value.	Check the power supply.
Fault inverter G1 F030 Fault inverter G1 F034 Fault inverter G1 F038	Short-circuit on the output of the frequency converter.	Check motor winding. Carry out insulation test.

*Chart 7-3: Faults triggered by the frequency converter G1 (WEG) (F000 - F399) (**RS**)*

Display	Possible Cause	Remedy
Fault inverter G1 F051 Fault inverter G1 F054 Fault inverter G1 F057	Frequency converter (VSD) overtemperature.	Check inlet filter of cooling air for switch cabinet for contamination, renew if necessary. See operating instructions for the compressor. Ensure that the ventilation of the switch gear cabinet and frequency converter fans are working correctly. Check frequency converter inlet and outlet for blockages in the cooling air supply and for dirty cooler fins.
Fault inverter G1 F074	Short-circuit on the output of the frequency converter.	Check motor winding. Carry out insulation test.

*Chart 7-3: Faults triggered by the frequency converter G1 (WEG) (F000 - F399) (**RS**)*

Faults triggered by the frequency converter fan G2 (WEG) (F1000 - F1399) (ARV)

Display	Possible Cause	Remedy
Fault inverter G2 F1xxx	The frequency converter (VSD) detected a fault with error number xxx that was not subsequently listed.	Contact Gardner Denver Service.
Fault inverter G2 F1006	Phase fault at the input power supply of the converter.	Check fuses, renew if necessary Check that all connecting terminals are tight; retighten if necessary.
	Asymmetry of the input voltage > 5 %.	Check the power supply.
	Fault in the upstream switch circuit.	Contact Gardner Denver Service.
Fault inverter G2 F1021	The input voltage is too low and the voltage of the DC bus has exceeded the permissible minimal value.	Check the power supply.
	Phase loss at the input power supply.	Check fuses, renew if necessary Check that all connecting terminals are tight; retighten if necessary.
	Failure in the upstream switch circuit.	Contact Gardner Denver Service.
Fault inverter G2 F1022	The input voltage is too high and the voltage of the DC bus has exceeded the permissible highest value.	Check the power supply.

*Chart 7-4: Faults triggered by the frequency converter (F1000 - F1399) (**ARV**)*

Display	Possible Cause	Remedy
Fault inverter G2 F1030 Fault inverter G2 F1034 Fault inverter G2 F1038	Short-circuit on the output of the frequency converter.	Check motor winding. Carry out insulation test.
Fault inverter G2 F1051 Fault inverter G2 F1054 Fault inverter G2 F1057	Frequency converter (VSD) overtemperature.	Check inlet filter of cooling air for switch cabinet for contamination, renew if necessary. See operating instructions for the compressor. Ensure that the ventilation of the switch gear cabinet and frequency converter fans are working correctly. Check frequency converter inlet and outlet for blockages in the cooling air supply and for dirty cooler fins.
Fault inverter G2 F1074	Short-circuit on the output of the frequency converter.	Check motor winding. Carry out insulation test.

*Chart 7-4: Faults triggered by the frequency converter (F1000 - F1399) (**ARV**)*

Faults triggered by the compressor (E400 - E495)

Display	Possible Cause	Remedy
E400: Power Supply Failure	Power failure.	Find cause.
	Voltage dip.	Find cause.
	Cabling damaged.	Check cabling, repair if necessary.
	Loose terminals.	Check that all connecting terminals and plugs are tight; retighten if necessary.
E401: Emergency Stop Activated	Emergency-stop is /has been activated.	Unlock the emergency-stop pushbutton.
	Emergency-stop pushbutton defective.	Check emergency-stop pushbutton, renew if necessary.
	Cabling damaged.	Check cabling, repair if necessary.
E402: High Motor Temp. M1	Drive motor has been started too frequently.	Limit number of starts/hour.
	Drive motor cooling defective.	Check cooling air supply, improve if necessary.
	Power consumption too high.	Check, find cause.
	Faulty power supply.	Check, find cause.
	Drive motor defective.	Check drive motor, replace if necessary.

Chart 7-5: Faults triggered by the compressor (E400 - E495)

Display	Possible Cause	Remedy
E403 Compressor Disch. Temp.	Compressor outlet temperature exceeded.[1)]	Find cause.
	Intake temperature too high.	Check cooling air supply, improve if necessary.
	Inadequate cooling.	Check cooling air or cooling water supply, increase as necessary.
	Unit being operated with enclosure open.	Close the enclosure.
	Oil injection volume/temperature too low/high.	Check, find cause.
	Incorrect oil grade/viscosity.	Check, if necessary replace oil.
	R2 temperature sensor defective (indication too high).	Check, renew if necessary.
E404 Start Temperature low	Start attempt at too low temperature.	Heat up compressor room.
	R2 temperature sensor defective (indication too low).	Check, renew if necessary.
E405 Discharge Over Pressure	Rated pressure exceeded by 1.5 bar / 21 psi.[1)]	
	1 Pressure losses in the system too high 2 Set line pressures too high 3 External pressure requirement too high 4 Intake controller not closing 5 Pressure sensor B1 or B2 defective (incorrect indication)	1 Check, find cause. 2 Correct. 3 Check remote on-load/off-load switching points. 4 Check, find cause. 5 Check, renew if necessary.
E406 Line Pressure Sensor B1	Faulty line pressure sensor.	Check, renew if necessary.
	Pressure and/or temperature sensor defective.	Check, renew if necessary.
	Cabling to sensor damaged.	Check, renew if necessary.
E407 Discharge Pressure Sensor B2	Faulty compressor final pressure sensor.	Check, renew if necessary.
	Pressure and/or temperature sensor defective.	Check, renew if necessary.
	Cabling to sensor damaged.	Check, renew if necessary.
E408 Disch. Temp. Sensor R2	Faulty compressor discharge temperature sensor.	Check, renew if necessary.
	Pressure and/or temperature sensor defective.	Check, renew if necessary.
	Cabling to sensor damaged.	Check, renew if necessary.

Chart 7-5: Faults triggered by the compressor (E400 - E495)

Display	Possible Cause	Remedy
E409 Controller Hardware	Controller hardware error	Renew Delcos Controller
E410 Cooling	Air-cooled systems:	
	1 Fan motor circuit breaker tripped 2 Resistances too high through delivery/discharge air channels 3 Fan-motor circuit breaker incorrectly set 4 Fan motor faulty	1 Check. 2 Check, install auxiliary fan if necessary. 3 Set to 110% of rated fan current. 4 Check, change if necessary.
	Water-cooled systems:	
	1 Inadequate cooling water supply 2 Cooling water temperature too high 3 Cooling water flow too low 4 Dirt trap blocked 5 Cooling water solenoid valve does not open 6 Air in system	1 Improve. 2 Improve. 3 Increase. 4 Clean. 5 Check, change if necessary. 6 Bleed.
E411 Oil Pressure Low	No/low oil pressure[3)]	Check, find cause.
E412 External Fault	Switch off by external device[3)]	Check, find cause.
E413: Dryer (compressor without speed control)	Fault in the integral or external dryer.[3)]	See Chapter on the integrated dryer in the compressor operating instructions.
E413: Dryer (Compressor with speed control)	Fault in the integral or external dryer.[3)]	Check, find cause.
E414 Condensate drain	Connected condensate drainage valves faulty.[3)]	Check, find cause.
E415 No Start Pressure	No pressure build-up in the start-up phase, e.g. because the drive motor is turning in the wrong direction.	Check, find cause.
E416 Heavy Startup	Discharge compression pressure too high during motor start phase.	Check that the intake regulator is closed and is sealing correctly.
E417 Motor temp. Fan M2	Fan motor M2 (**ARV**) defective	Check, change if necessary.

Chart 7-5: Faults triggered by the compressor (E400 - E495)

1) System specific setting. See "Factory Settings" menu.
3) Monitoring through optional device/sensor connected to a programmable digital input. See chapter "Programmable Inputs" and wiring diagram.

Faults triggered by the frequency converter (E500 - E531) (RS or ARV)

Display	Possible Cause	Remedy
E500: Pre-Adjustment VSD G1	The VSD was faulty or not programmed (replacement device), so that it had to be reprogrammed by the DELCOS XL.	
E501: Pre-Adjustment VSD-G1	The VSD was faulty or not programmed (replacement device), so that it had to be reprogrammed by the DELCOS XL.	
E502: VSD Locked Only applicable for Allen Bradley frequency converter	Error during programming of the VSD.	Contact Gardner Denver Service.
E503: VSD Write Fault G1	Error during programming of the VSD.	Contact Gardner Denver Service.
E504: Communication VSD-G1	Communication with the VSD interrupted, VSD does not respond.	Check main contactor (Compressors with PowerFlex 400 VSD only). Check the Modbus interface wiring. If no fault is found, contact Gardner Denver Service.
E505: VSD Stop Pressed Only applicable for Allen Bradley frequency converter	The red Stop button on the frequency converter (VSD) was pressed while the compressor was running.	Always switch the compressor off via the DELCOS XL.
E506: VSD-G1 Emergency-Off input	During the period that the DELCOS XL had detected that an Emergency Stop button had been pressed, no corresponding feedback was received from the VSD.	Check EM-Stop circuit. This fatal fault cannot be reset. Re-powering the compressor will run the Setup Code procedure. See chapter "Setting up a replacement controller / setup code and compressor reference number".
E507: VSD-G1 Read Fault	Fault when reading data from the VSD.	Contact Gardner Denver Service.
E508: VSD-G1 Emergency-Off input	During the period that the VSD had detected that an Emergency Stop button had been pressed, no corresponding feedback was received from the DELCOS XL.	Check EM-Stop circuit. This fatal fault cannot be reset. Re-powering the compressor will run the Setup Code procedure. See chapter "Setting up a replacement controller / setup code and compressor reference number".
E509: See VSD-G1 display	An unexpected fault code was received from the VSD.	Read off the displayed fault code from the VSD display and contact Gardner Denver Service.

*Chart 7-6: Faults triggered by the frequency converter (E500 - E531) (**RS or ARV)***

Display	Possible Cause	Remedy
E510: Speed below min. Limit only for main drive motor	Speed is below permissible minimum rotational speed.	Check the differential pressure of the fine separator. Check the oil level. Check the water content of the oil.
E511: Pre-Adjustment VSD G2	The VSD was faulty or not programmed (replacement device), so that it had to be reprogrammed by the DELCOS XL.	
E512: Pre-Adjustment VSD-G2	The VSD was faulty or not programmed (replacement device), so that it had to be reprogrammed by the DELCOS XL.	
E513: VSD Write Fault G2	An error occurred while the frequency converter was being programmed.	Contact Gardner Denver Service.
E514: Communication VSD-G2	Communication to frequency converter disrupted, frequency converter is not responding.	Check ModBus interface wiring. If no fault can be found, notify Gardner Denver Service.
E515: VSD-G2 Emergency-Off input	During the period that the DELCOS XL had detected that an Emergency Stop button had been pressed, no corresponding feedback was received from the VSD.	Check EM-Stop circuit. This fatal fault cannot be reset. Re-powering the compressor will run the Setup Code procedure. See Chapter: “Setup Code and Compressor Identification Number”.
E516: VSD-G2 Read Fault	An error occurred while reading data from the frequency converter.	Contact Gardner Denver Service.
E517: VSD-G2 Emergency-Off input	During the period that the VSD had detected that an Emergency Stop button had been pressed, no corresponding feedback was received from the DELCOS XL .	Check EM-Stop circuit. This fatal fault cannot be reset. Re-powering the compressor will run the Setup Code procedure. See Chapter: “Setup Code and Compressor Identification Number”.
E518: See VSD-G2 display	An unexpected fault code was received from the VSD.	Read displayed fault code from VSD display and notify Gardner Denver Service.

*Chart 7-6: Faults triggered by the frequency converter (E500 - E531) (**RS or ARV**)*

Warnings triggered from the compressor (A900 - A995)

Display	Possible Cause	Remedy
A600: Service due	Hours to next Service below 200 hours.	Service the compressor corresponding to service instructions.

Chart 7-7: Warnings triggered from the compressor (A600 - A695)

Display	Possible Cause	Remedy
A601: Discharge Over Pressure	Rated pressure exceeded by 1.0 bar / 14 psi [1)] 1 Pressure losses in the system too high 2 Set line pressures[4)] too high 3 External pressure requirement too high 4 Intake controller not closing. 5 Pressure sensor B1 or B2 defective (incorrect indication)	• Check, find cause. • Correct. • Check remote on-load/off-load switching points. • Check, find cause. • Check, renew if necessary.
A602:Compressor Disch. Temp.	Final compression temperature exceeded. [1)]	Find cause.
	Intake temperature too high.	Improve.
	Inadequate cooling.	Improve.
	Unit being operated with enclosure open.	Close the enclosure.
	Oil injection volume/temperature too low/high.	Check, find cause.
	Incorrect oil grade/viscosity.	Check, if necessary replace oil.
	R2 temperature sensor defective (indication too high).	Check, renew if necessary.
A603:	Not used / reserved	
A604:	Not used / reserved	
A605:	Not used / reserved	
A906: Line Pressure high	For more information, see "Configuration / Advanced Settings / Remote Load and Off-load"	
A607: Controller Battery empty	Battery empty	Renew battery: Gardner Denver Part no. 100016235
A608: Dryer (compressor without speed control)	Fault in the integral or external dryer.[3)]	See Chapter on the integrated dryer in the compressor operating instructions.
A608: Dryer (Compressor with speed control)	Fault from external dryer.[3)]	Check, find cause.
A609: Condensate Drain	Connected condensate drain valves (Bekomat) defective [3)]	Check, find cause.
A610: Fine separator	Differential pressure of the fine separator too high [3)]	Check, renew fine separator if necessary.
A611: Air Filter	Differential pressure of the air filter too high [3)]	Check, change air filter if necessary.

Chart 7-7: Warnings triggered from the compressor (A600 - A695)

Display	Possible Cause	Remedy
A612: Oil Filter	Differential pressure of the oil filter too high 3)	Check, renew oil filter if necessary.
A613: Oil level low	Oil level too low. 3)	Check, replace oil if necessary.
A614: Oil temperature high	High oil temperature.3)	Check, find cause.
A615: External Warning	Warning due to external device.3)	Check, find cause.
A616: Motor lubrication system	A fault has occurred in the motor greasing system or the LC unit is running low. 3)	See Chapter on Motor greasing system in the operating instructions for the compressor system.
A617: Input 1	The programmable digital input 1 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A618: Input 2	The programmable digital input 2 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A619: Input 3	The programmable digital input 3 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A620: Input 4	The programmable digital input 4 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A621: Input 5	The programmable digital input 5 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A622: Input 6	The programmable digital input 6 was activated, but is nevertheless programmed as [free]. 3)	Check the assignment of the input in question. 3)
A623: SD-Card full	The SD card storage space is used up.	Renew SD card. CompAir Part No. ZS1067681

Chart 7-7: Warnings triggered from the compressor (A600 - A695)

1) System specific setting. See menu "Factory Settings"
3) Monitoring through optional device/sensor connected to a programmable digital input. See chapter "Programmable Inputs" and wiring diagram
4) Water-cooled version only (W-version)

Warnings triggered by the frequency converter (A700 - A731) (RS or ARV)

Display	Possible Cause	Remedy
A700: VSD Temp. G1 high	Frequency converter (VSD) temperature close to trip temperature.	Check the cooling air inlet filter of the switch cabinet for dirt and renew if necessary. See the compressor operating instructions. Ensure that the through ventilation of the switch cabinet and the VSD fans are working correctly. Check VSD outlet and inlet for blockages in the cooling air supply and dirty cooler fins.
A701: VSD Temp. G2 high	Frequency converter (VSD) temperature close to trip temperature.	Check inlet filter of cooling air for switch cabinet for contamination, renew if necessary. See operating instructions for the compressor. Ensure that the ventilation of the switch gear cabinet and frequency converter fans are working correctly. Check frequency converter inlet and outlet for blockages in the cooling air supply and for dirty cooler fins.

*Chart 7-8: Warnings triggered by the frequency converter (A700 - A731) (**RS or ARV)***

Other faults

Fault	Possible Cause	Remedy
A fault/warning cannot be acknowledged.	Fault/warning still in place.	Find cause and remedy.
Incorrect display of volume flow.	Volumetric flows incorrectly set.	Check the max. and min. volume flow in the menu "Configuration". See chapter "Menus / configuration".
Unit not automatically starting after power loss.	Automatic restart after power failure is not enabled. Power loss lasted too long.[1)]	Activate automatic restart after power failure.
Unit runs continuously in off-load without independently switching to readiness (stand-by).	Operating mode "Continuous operation" selected.[1)] Very brief pressure demand during the run-on time.	Select operating mode "Automatic operation".

Chart 7-9: Other faults

1) Unit-specific setting: See "Control" menu.

8 ADVANCED OPERATION

8.1 Maintenance Level

The maintenance level allows local maintenance personnel to change certain additional parameters which are blocked at the user level. Additionally other graph screens or selection options are available.

Enabling and blocking the maintenance level

1 Tap the <Access Code> tab.
   – The input menu "Access Code" appears.
2 Tap the <Number buttons> to enter the access code "3100".
   If necessary, make any corrections with the <Back> button.
3 Tap the <Enter> button.
✓ The maintenance level is enabled.
   – The corresponding operating functions are enabled.
   – A "2" appears next to the padlock symbol on the <Access Code> tab.

To block the maintenance level, enter the same access code again.

NOTE

The maintenance level is automatically blocked after five minutes, the controller automatically activates the user level.

8.2 Additional maintenance level graph screens

The following graph screens or selection options are additionally available in the menu "Trends" under the maintenance level:

- In the graph screen "Line pressure", the button <Show Targets>
- Heatsink Temperature (**RS**)
- VSD Output Current (**RS**)
- Final compression pressure
- Output temperature
- Line Pressure - Show Targets
- Motor speed of fan M2 (**ARV**)

In the graph screen "Line pressure", the button <Show Targets>

An additional button <Show Targets> appears on the graph screen "Network pressure".

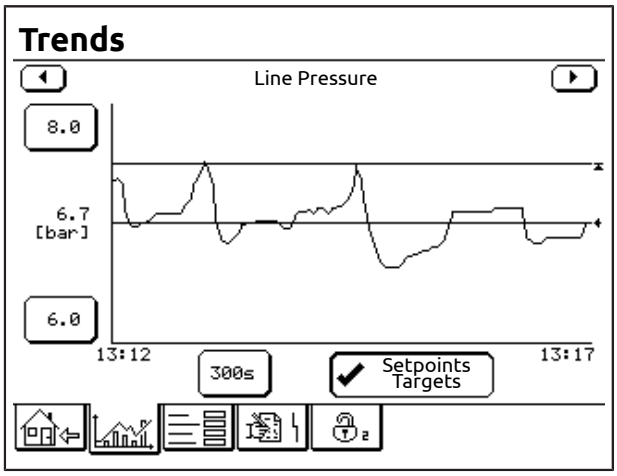


Fig. 8-1: Graph screen "Network pressure" with button <Show Targets>

1 Tap the <Show Targets> button.
   – Alongside the lettering "Show Targets" an additional tick appears on the button.
   – On the diagram in addition to the Line Pressure curve the setpoints for the upper and lower pressure values are displayed.

Heatsink Temperature

Also available under the maintenance level is the graph screen "Heatsink Temperature".

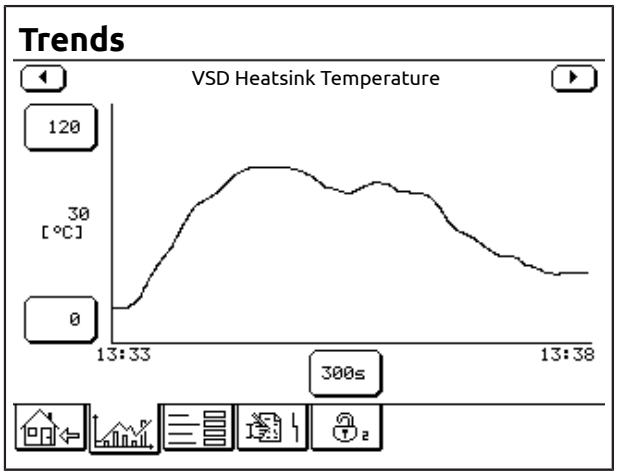


Fig. 8-2: Graph screen "Heatsink Temperature"

The graph shows the variation with time of the temperature of the heatsink in the power unit of the VSD.

VSD Output Current

Also available under the maintenance level is the graph screen "VSD Output Current".

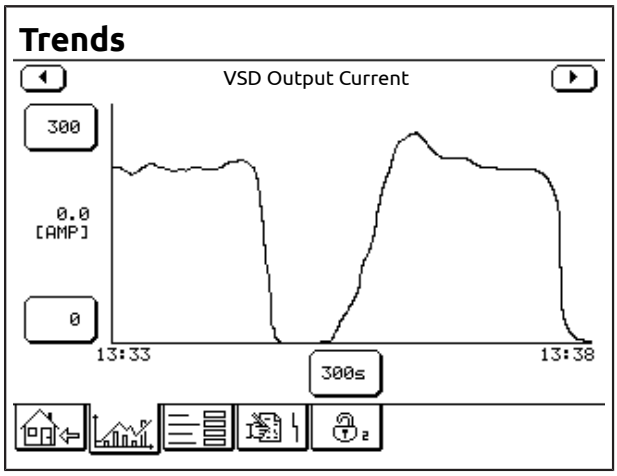


Fig. 8-3: Graph screen "VSD Output Current"

The graph shows the variation with time of the VSD output current.

8.3 Resetting the statistics on-load hours

The statistics (recording) of the hours on-load can be reset (deleted) within maintenance level under the graph "Statistics On-Load Hours".

1 Tap the <Trends> tab.

2 Using the <arrow keys> call up the graph screen "Statistics On-Load Hours".

– The button <Re-Set Statistics> is enabled under the maintenance level.

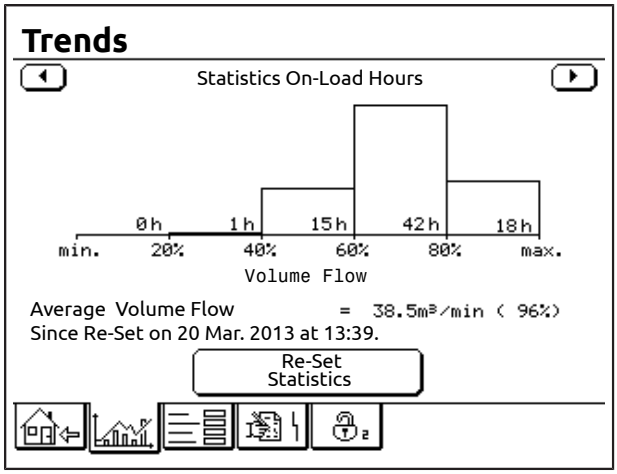


*Fig. 8-4: Graph screen "Statistics On-Load Hours" (Example **RS**)*

3 Tap button <Re-Set Statistics>.

– The security query "Are you sure you want to re-set the Statistics Data?" appears.

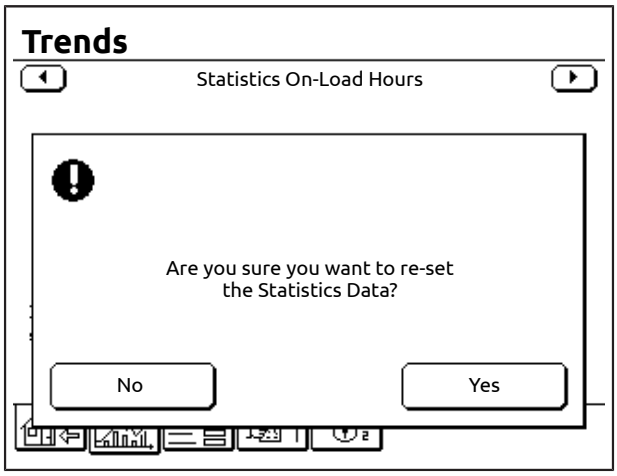


Fig. 8-5: Security query "Are you sure you want to re-set the Statistics Data?"

4 Tap button <Yes>.

✓ The record data of the hours on-load is reset.

– The bar graph is deleted.

– The text details are updated.

or

5 Tap button <No>

– The record data of the hours on-load is retained.

In both cases the graph screen "Statistics On-Load Hours" is displayed again.

8.4 Setting the service interval

Under maintenance level the menu "Hour Meters" can be used to set the time until the next due service (service interval).

1 Tap the <Settings> tab.

– The screen "Settings" appears.

2 Tap button <Hour Meters...>.

– The menu "Hour Meters" appears.

3 Tap button <Hours to next Service>.

– The input menu "Hours to next Service" appears.

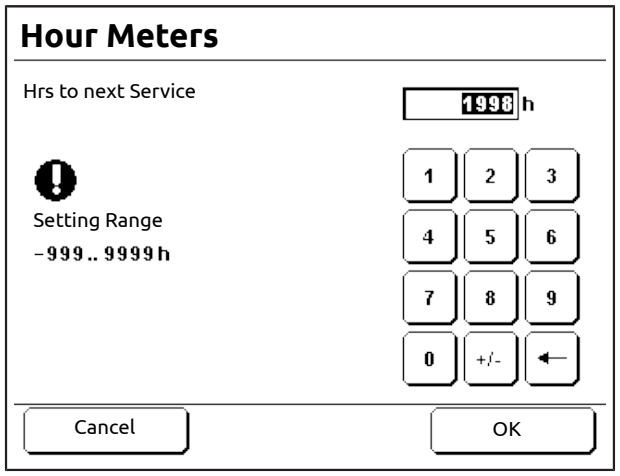


Fig. 8-6: Input menu "Hours to next Service"

1 Tap the <Number buttons> to enter the service interval.
Corrections can be made with the <Back> button.

The <Cancel> button can be used to cancel setting of the service interval. The previously active setting is used.

2 Tap the <OK> button.

✓ The service interval is set.

– The entered value is saved.

– The menu "Hour Meters" is displayed.

– The time set until the next service is displayed on the button <Hours to next Service>.

8.5 Data logging

The controller has a data recording (data logger) function by recording of data to an SD-Card. This function can be used to monitor and store various compressor parameters.

Inserting and removing an SD-Card

The SD card slot is located on the back of the controller.

1 Switch the main switch OFF.

2 Open the switch cabinet door and swing sufficiently open.

⚠ DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

⇨ With the speed-controlled types (**ARV**) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage. (**Only applicable for Allen Bradley frequency converter**)

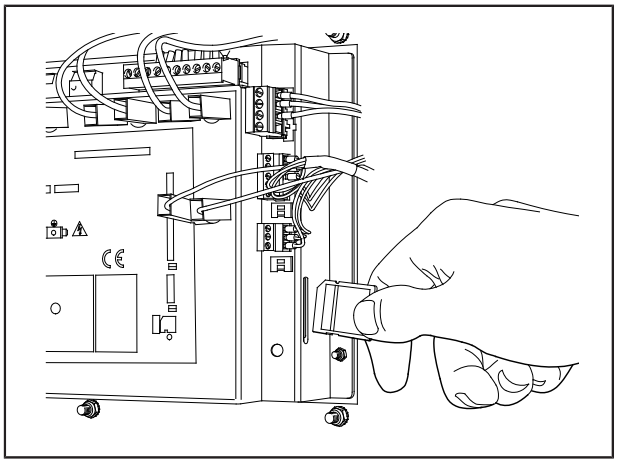


Fig. 8-7: Inserting and removing an SD-Card

3 Clear the SD-Card write protection.

4 Insert the SD-Card in the correct position.

5 Press the SD-Card in fully.

6 Close the switch cabinet door.

To remove the SD-Card, press the inserted SD card in fully. The SD-Card is unlocked and ejected.

NOTICE

Data loss

⇨ Ensure that data recording is switched OFF before the SD-Card is removed.

Starting and stopping data recording

Starting data recording

1 Tap the <Settings> tab.

2 Tap button <SD-Card>.

3 Tap button <Record Data>.

4 Select data recording option "3" or "60" seconds interval.

5 Tap the <OK> button.

✓ Data recording starts immediately.

– The menu "SD-Card" appears.

– Note "Recording". Moreover the file name of the recording file is displayed.

Stopping data recording

1 Tap the <Settings> tab.

2 Tap button <SD-Card>.

3 Tap button <Record Data>.

4 Select data recording option "Off".

5 Tap the <OK> button.

✓ Data recording stops immediately.

– The menu "SD-Card" appears.

– Note "Ready".

Recorded data

When a data recording session is started, the controller saves a settings file which contains all the current settings and configuration details of the controller.

The file name comprises the start date and is suffixed "S00":
YYYYMMDD.S00 (The "S" identifies this as a "Settings file", where YYYY denotes Year, MM denotes Month, DD denotes Day.)

The controller then begins monitoring and recording the machine's data at the intervals chosen in the "SD-Card" menu.

To do this the controller creates a data file. The file name comprises the start date and is suffixed "D00":
YYYYMMDD.D00 (The "D" identifies this as a Data file, where YYYY denotes Year, MM denotes Month, DD denotes Day.)

A new data file is written every subsequent day that the recording session is allowed to continue, each with its own date-based file name.

If more than one data recording session occurs during the same day (and therefore file names have the same date), the suffix number is incremented to show which are the earliest and latest files recorded on any given day.

When the recording session is ended by the user, a second Settings file containing the settings and configuration details of the controller at the end of the recording session is written to the SD card.

The file name comprises the date and is likewise suffixed "S00":
YYYYMMDD.S00 (The "S" identifies this as a further settings file).
The settings can be read from this settings file and entered in the "Adjustment values" table in the appendix to these operating instructions.

All files have the TSV (tab-separated values) text format and can be imported and viewed in a spreadsheet program, for example.

SD Card Format

The Data Recorder function supports both SD and SDHC cards. It will not work with SDXC cards.

The SD-Card should be FAT32 formatted. SD card driver compatibility cannot be guaranteed for any SD card other than the card with part no. ZS1105017.

Gardner Denver recommends use of the DELCOS XL SD card reader. Part no. ZS1069300.

9 SETTING UP A REPLACEMENT CONTROLLER

9.1 The Setup Code and Compressor Identification Number

NOTICE

Material damage

The setup code and identification number are unique to each compressor. If a setup code from another compressor is used, the compressor is incorrectly configured, which can lead to considerable compressor damage.

⇨ Under no circumstances must data from another compressor be used.

NOTE

It is recommended that setup code and compressor reference number are noted down and these made available before the controller is switched on.

DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

⇨ With the speed-controlled types (**ARV**) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage. (**Only applicable for Allen Bradley frequency converter**)

The setup code

The setup code defines all the basic factory compressor settings.

The setup code comprises 16 characters. The setup code is located on a sticker inside the switch cabinet.

Compressor identification number

The compressor reference number is the compressor serial number.

The compressor reference number comprises 13 characters and starts "CD". The compressor reference number is located on the nameplate.

9.2 Setting up a replacement controller

Changing controller

DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

⇨ With the speed-controlled types (**ARV**) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage. (**Only applicable for Allen Bradley frequency converter**)

1 Switch the main switch OFF.
2 Open the switch cabinet door and swing sufficiently open.
3 Remove the electrical connections.
4 Remove the nuts from the studs.
5 Take out the controller.
6 Insert the replacement controller and secure using the nuts.
7 Plug in the electrical connections.
8 Close the switch cabinet door.

Switching on the replacement controller for the first time

1 Switch the main switch ON.
   – The menu "Choose Language" appears.

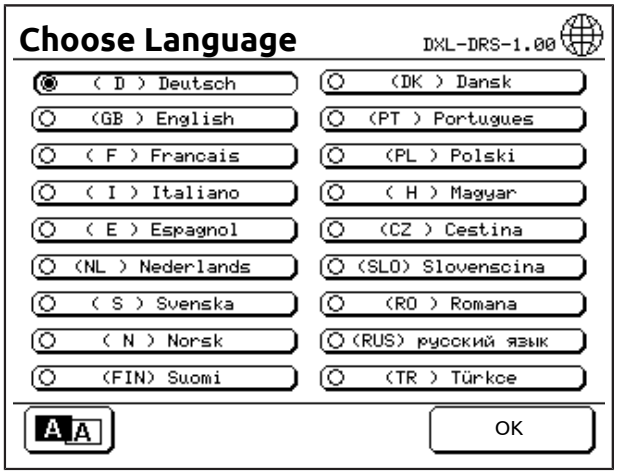


Fig. 9-1: Menu "Choose Language"

2 <Tap the <Button> for the required language.

– The display language is selected.

3 Tap the <OK> button.

✓ The display language is changed to the selected language.

– The input menu "Setup Code" opens.

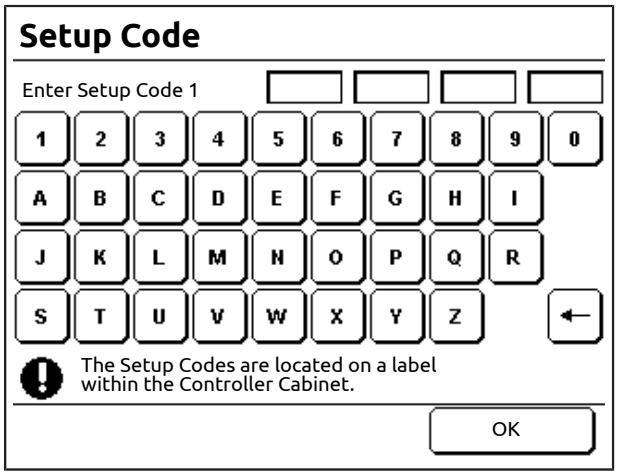


Fig. 9-2: Input menu "Enter Setup Code 1"

4 Tap the <Softkeys> to enter the Setup Code.

5 Tap the <OK> button.

– The input menu "Enter Reference Number" opens.

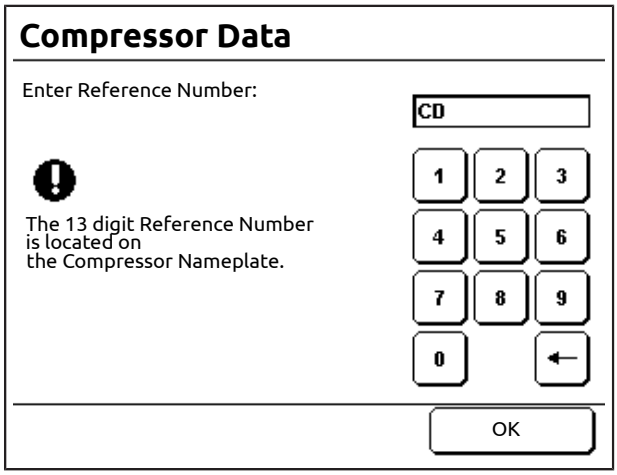


Fig. 9-3: Input menu "Enter Reference Number"

6 Tap the <Softkeys> to enter the compressor reference number.

When the entry is complete, the <OK> button appears.

7 Tap the <OK> button.

– The security query "Reset system settings" appears.

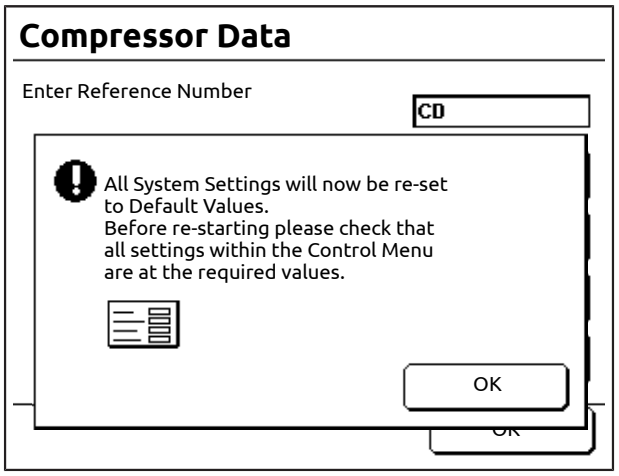


Fig. 9-4: Security query "Reset system settings"

8 Tap the <OK> button.

– All settings are reset to the basic factory compressor settings.

– (**FS**) The menu "Home" appears.

✓ The FS compressor is ready for operation.

RS + ARV compressor

On RS + **ARV** compressor after confirming the safety query "Reset system settings" the menu “Overview" appears with the message"Converter is being parametrize".

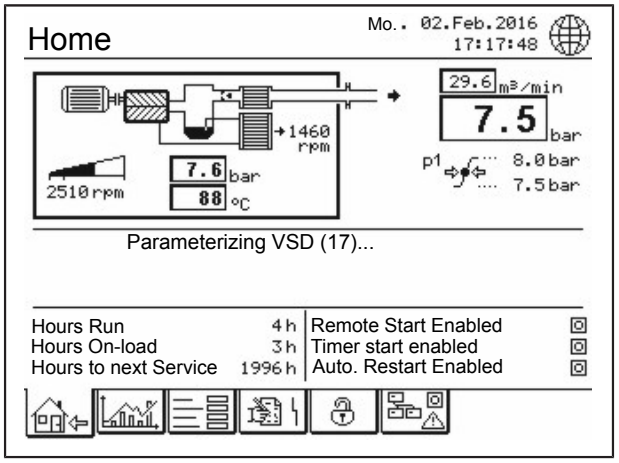


Fig. 9-5: Menu "Home" with message "Parameterizing VSD"

– The VSD is parameterized.

Once VSD parameterizing is completed:

– Menu "Home" appears with the message "Ready to Start".

✓ The RS compressor is ready for operation.

Testing the emergency-stop function

On RS + **ARV** compressor this test guarantees that the converter and control have correctly detected the emergency stop-input.

When the following request appears.

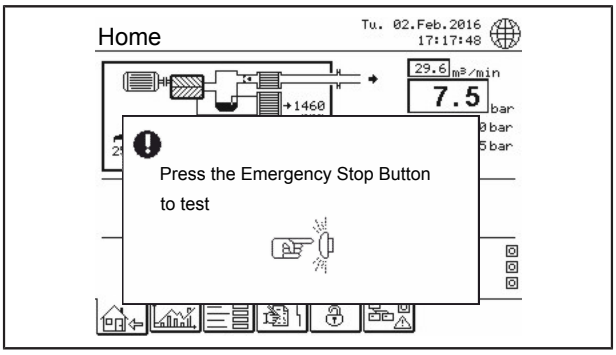


Fig. 9-6: Request "Press Emergency Stop Button"

1 Press the <Emergency-stop> pushbutton.

– The message "Emergency Stop Activated" is displayed.

– The symbol on the <Fault History> tab flashes.

2 Unlock the <Emergency-stop> pushbutton.

3 Tap the <Fault History> tab.

4 Tap the <Reset> button.

– The symbol on the <Fault History> tab stops flashing.

✓ The controller is ready for use.

Checking settings

NOTE

All specific settings should be recorded, so that if necessary they are available (e.g. for setting up a replacement controller).

The settings can be entered in the "Adjustment values" table in the appendix to these operating instructions.

Before the compressor is started for the first time after installation of the replacement controller, all settings must be checked.

In particular, the specific settings must be re-entered.

10 BASE LOAD SEQUENCING (BLS)

The following chapter principally describes the master controller in base load sequencing.

Where the slave controllers are concerned, it is only necessary to set the address. See chapter "Configuration / Setup RS485 Communication / Setting up the communication parameters of the slave compressor controller".

10.1 Base Load Sequencing

General description

The controller DELCOS XL can act as the master controller for a base load sequencing group.

Up to three slaves can be connected to the master via a serial link.

NOTE

All slave compressors must be of the same type, i.e. either RS compressors only or FS compressors only.

Base load sequencing function

The Base Load Sequencing feature is optional.

Base Load Sequencing has two functions:

- One central superior controller (the master controller) is utilised to control a group of compressors in order to maintain the line pressure within a narrow pressure band.
- The master controller regularly changes the priorities of the compressors in the group ensuring that the running hours of all compressors are equal.

System Requirements

A communication module (RS485:3 module) must be installed in the master controller, if it has not been pre-installed ex-factory.

Supported compressor group configurations

Type	Description / requirement
FS-Master FS-Slaves	One FS master can control up 3 FS slaves. The rated volume flow of each compressor within the base load sequencing group should be approximately the same as the master.
RS master FS-Slaves	One RS master can control up 3 FS slaves. The rated volume flow of each slave compressor should be equal to or slightly less than the master.
RS master RS slaves	One RS master can control up 3 RS slaves. The rated volume flow of each compressor within the base load sequencing group should be approximately the same as the master.

Chart 10-1: Supported compressor group configurations

NOTE

One FS master cannot control any RS slaves.

10.2 Supported slave controllers

Supported slave controllers

The electronic slave controllers DELCOS 3100, DELCOS PRO and DELCOS XL are supported with the minimum required software version. See the following table.

If it is necessary to connect any other compressor controller, or a compressor with electro-mechanical control, to the master, a device known as a compressor module (STD) can be installed into the slave (see chapter "Installing the compressor module (STD)"). This compressor module controls the on-load/off-load switching of the compressor, monitors its status such as "Ready" and "On-Load" and is connected to the master via a serial link.

Supported slave compressor controllers and required software versions

The following compressor controllers are supported and must have a software version number not less than one of those stated below:

Electronic Controller	Minimum Required Software Versions
DELCOS XL-D	DXL-D-1.00
DELCOS XL-DRS	DXL-DRS-1.00
DELCOS XL-DH	DXL-DH-1.00
DELCOS XL-DHRS	DXL-DHRS-1.00
DELCOS XL-L	DXL-L-1.02
DELCOS XL-LRS	DXL-LRS-1.04
DELCOS PRO-L	DPro-L-1.18
DELCOS PRO-LRS	DPro-LRS-1.02
DELCOS PROG-LSR	DPro-LSR-1.05
DELCOS 3100-L	SD31V2.05
DELCOS 3100-LRS	SD31R2.03
DELCOS 3100-LRS (V2)	D31RS1.06
DELCOS 3100-LSR	SD31S1.16
DELCOS 3100-DH	HD31V2.05
DELCOS 3100-DHRS	HD31R1.34
DELCOS 3100-DHSR	HD31S1.22

Chart 10-2: Required Software Versions

The software version can be checked in the controller menu structure. More detailed information is contained in the operating instructions of the relevant controller.

When a software update is necessary, contact Gardner Denver.

10.3 Menu "Base Load Sequencing"

Activating and deactivating base load sequencing

1 Tap the <Access Code> tab.
  – The input mask "Access Code" opens.
2 Tap the <Number buttons> to enter the access code "1234".
3 If necessary, make any corrections with the <Back> button.
4 Tap the <Enter> button.
✓ Base load sequencing is activated.
  – The <Base Load Sequencing> tab is displayed.

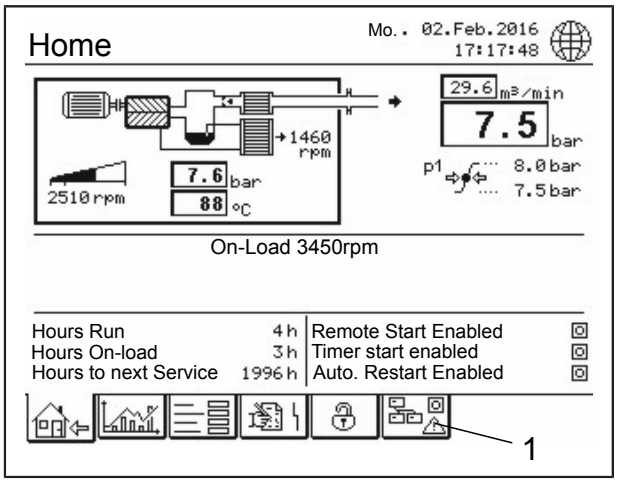


Fig. 10-1: Menü "Home" with tab <Base Load Sequencing>

To deactivate base load sequencing enter the same access code again.

NOTE

The Base Load Sequencing feature can be activated even if the RS485:3 module is not installed. In this case, you will get a communication fault message because the master cannot establish communication with the slaves, as they are not connected. See chapter "Installing the RS485:3 module"

Symbols on the tab <Base Load Sequencing>

The symbols which are displayed on the tab next to the symbol, can vary according to the base load sequencing operating state. The following information is displayed:

Symbol	Meaning
⧈	Base Load Sequencing is switched off. All compressors operate independently of each other, according to their respective settings.
⧈	Base Load Sequencing is switched on.
⧈	Base Load Sequencing is switched on and timer-controlled.
⚠	An alarm is displayed in the "Base Load Sequencing" menu.

Chart 10-3: Symbols on the tab <Base Load Sequencing>

Menu "Base Load Sequencing"

If the tab <Base Load Sequencing> is activated, tapping allows the menu "Base Load Sequencing (BLS)" to be called up.

If the menu "Base Load Sequencing (BLS)" is called before the slave compressors have been defined or the BLS function is switched off, a corresponding message is displayed.

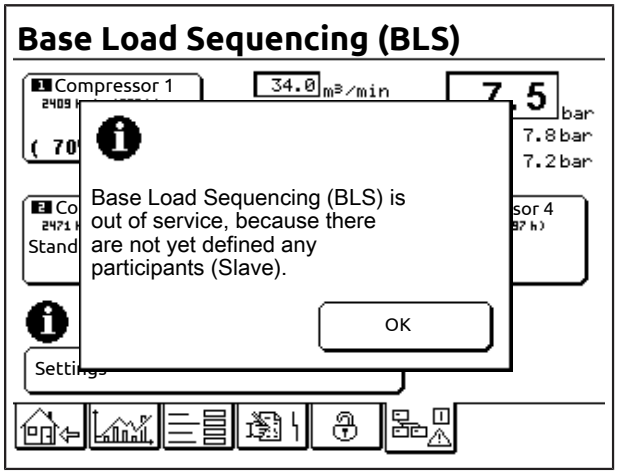


Fig. 10-2: Message "No participants (slaves) have been defined yet"

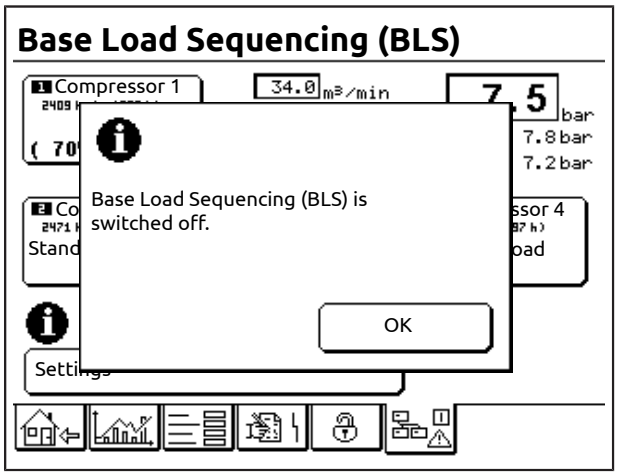


Fig. 10-3: Message "BLS is switched off"

1 Tap button <OK> to acknowledge the message.

– The message is closed.

– The menu "Base Load Sequencing (BLS)" appears.

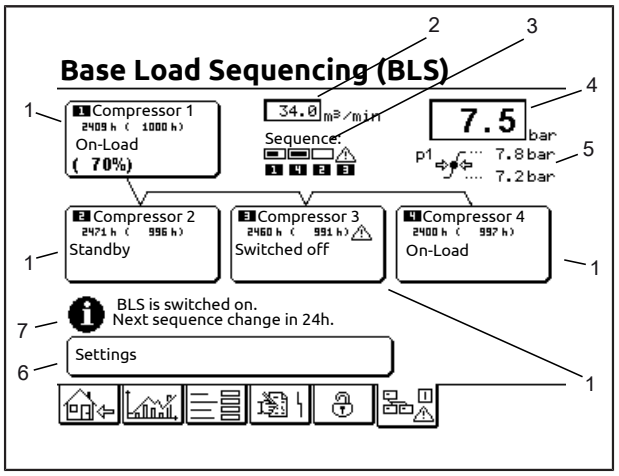


Fig. 10-4: Menu "Base Load Sequencing (BLS)" (typical display)

[1] Buttons <Compressor>

[2] Volume flow

[3] Sequence and Status Indicator

[4] Network pressure

[5] Pressure band

[6] Button <Settings>

[7] BLS status information

The above example shows a base Load Sequencing group comprising the master ("Compressor 1") and three slaves.

[1] button <Compressor>

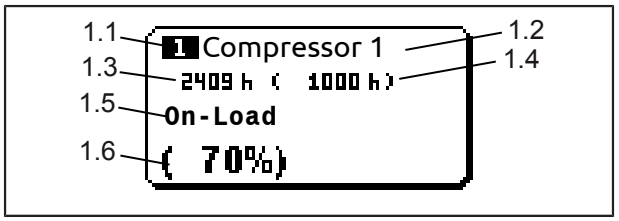


Fig. 10-5: Button <Compressor>

[1.1] RS485 address

[1.2] Designation

[1.3] Operating hours

[1.4] Operating hours (BLS)

[1.5] Compressor status message (see chapter "Compressor status messages")

[1.6] Percentage of the current compressed air flow rate (see chapter "Compressor status messages")

Tapping the button <Compressor> opens an information menu for the compressor with the option of Setting compressor data. See chapter "Compressor settings and information".

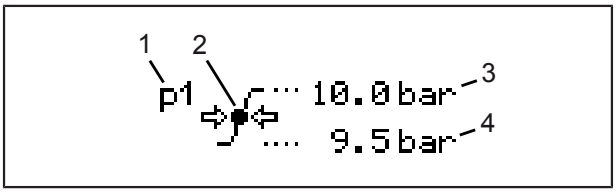
[2] Volume flow

Displays the currently supplied volume flow of the BLS group.

[3] Line pressure

Display of the current air pressure in the compressed air network.

[4] Pressure band



[1] Current pressure band

[2] International pressure symbol

[3] Upper pressure value

[4] Lower pressure value

If base load sequencing is switched on, this display indicates the lower and upper pressure values, at which the next available compressor will be switched on or off.

With RS compressors, the target pressure of the BLS group lies exactly between both values.

The symbols "p1" or "p2" and the optional "Clock symbol" indicate the pressure band used and whether the timer control is operating.

[5] Sequence and Status Indicator

Fig. 10-6: Sequence and Status Indicator

Sequence display:

If base load sequencing is switched on, this display indicates the current sequence (sequence in which the compressors are switched on). In the example shown above (1-4-2-3) the compressor on the left is the base load compressor; the other compressors are consecutively activated from left to right, as the demand for air increases.

Status indicator:

The status of the compressor in the group is displayed above the sequence indicator by the following symbols:

Symbol	Meaning
No symbol	Compressor not defined
▭	Compressor off-load
▬	Compressor on-load (**FS**)
▬	On-load bar graph (**RS**)
⚠	Compressor not available (switched off, no communication, fault etc.).

Chart 10-4: Status indicator symbols

[6] BLS status information

The base load sequencing status is indicated in defined status messages.

Button <Settings>

Tapping a <Settings> button opens a menu to set the base Load Sequencing parameters. See "Base Load Sequencing Settings" chapter.

10.4 Compressor Status Messages

Messages in normal operation

Message	Meaning
Standby	The compressor is ready for start-up by the master.
Start phase...[1)]	The drive motor is started.
Off-Load	The compressor is currently off-load.
On-Load	The compressor is currently on-load. (**FS**)
On-load (xxx %)[1)]	Percentage of the current compressed air flow rate (min. up to 100 %). (**RS**)
Motor run out phase...[1)]	The drive motor has been switched off and the controller is waiting until the final stationary state.
Load requested.....	The compressor has received a load request but hasn't started yet.

Chart 10-5: Compressor Status Messages

1) Not displayed for slaves controlled by the compressor module (STD).

Messages displayed if a compressor is not available

If a compressor is not available this is indicated by a flashing alarm symbol on the tab <Base Load Sequencing>.

Message	Meaning
No communication	No communication can currently be established with the slave.
Fault	Fault at the compressor.
Switched off 1)	The compressor is switched off and is therefore not available.
Incorrect configuration	The base load sequencing configuration indicates that no RS slaves are connected, the slave is nevertheless an RS compressor. or The base load sequencing configuration indicates that RS slaves are connected, the slave is nevertheless an FS compressor.
Not compatible1)	The slave is not compatible. Slave compressor controller or software version not supported.

Chart 10-6: Compressor Status Messages

1) Not displayed for slaves controlled by the compressor module (STD).

10.5 Compressor settings and information

Menu "Compressor"

Calling

1 Tap the <Base Load Sequencing> tab.

2 Tap button <Compressor x> for the desired compressor.

– The menu "Compressor / Select a Setting" appears.

Description

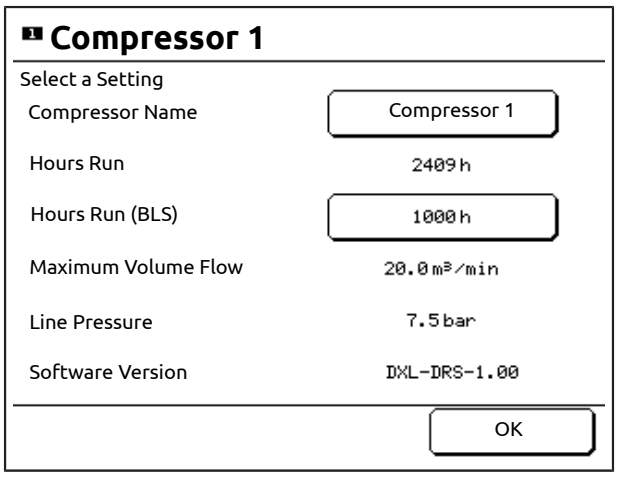


*Fig. 10-7: Menu "Compressor / Select a Setting" (Example **RS**)*

NOTE

Dependent on controller and compressor type (RS or FS) there are differences in the button allocations. See the following descriptions.

Compressor Name

The compressor name can be freely changed.

Changing the compressor name in the base load sequencing group

1 Tap the <Base Load Sequencing> tab.

2 Tap the <Compressor> button for the desired compressor.

3 Tap button <Compressor Name>.

– The soft keypad appears.

4 Tap the <Softkeys> to enter the desired compressor name.

5 Use the <Back> button to make corrections.

Use the <Cancel> button to cancel changing of the compressor name. The previously active name is used.

6 Tap the <OK> button.

✓ The compressor name is changed.

– The menu "Compressor" appears.

– The entered name is displayed on the <Compressor> button.

Hours Run

Display of the current hours run of the compressor.

If the compressor is connected via the STD module, the actual compressor hours run cannot be serially read in. In this case there is a button here to set the hours run. After tapping the button, an input menu appears for entry of the current compressor hours run.

Hours Run (BLS)

The BLS sequence will be redefined regularly on the basis of the operating hours (BLS) shown here. If this setting differs from the actual operating hours on the compressor button, both values are displayed on the compressor button.

For the cyclic specification of a BLS sequence, see chapter "BLS function description / Specification of a new BLS sequence based on the hours run (BLS)".

Maximum Volume Flow

Display of the maximum volume flow. (**FS**)

Display of the maximum available volume flow at the current line pressure. (**RS**)

For some slaves this setting must be configured manually. Accordingly a button is then available here. After tapping the button, an input menu appears for entry of the compressor maximum volume flow.

Line Pressure

Display of the current line pressure measured by the compressor.

This line is not displayed for compressors controlled by the compressor module (STD).

Software Version

Display of the controller software version.

10.6 Base Load Sequencing Settings

Calling

1 Tap the <Base Load Sequencing> tab.

2 Tap button <Settings>.

– The menu "Settings" appears.

Description

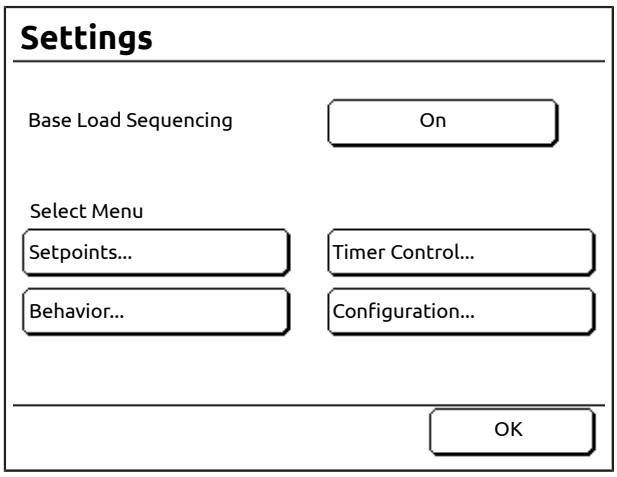


Fig. 10-8: BLS menu "Settings"

Base load sequencing <On> / <Off>

Switching on and off of base load sequencing.

Base load sequencing can only be turned on when the number of slaves is greater than zero. If base load sequencing is switched on, the slaves will be controlled by the master. The local setpoints of the slaves are ignored.

If base load sequencing is switched off, the slaves will run independently from the master and will use their local setpoints. The BLS group is still displayed.

Setpoints

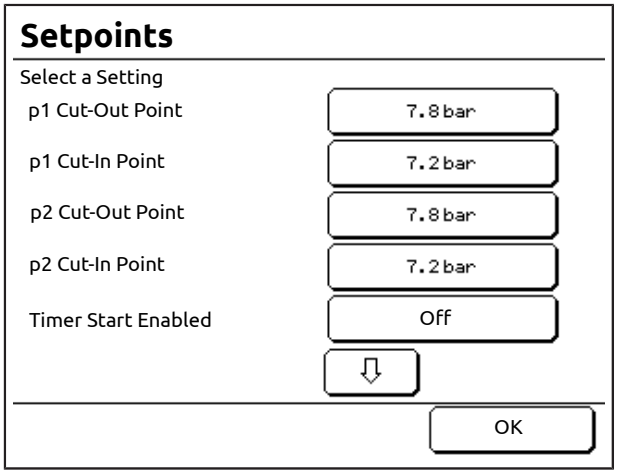


Fig. 10-9: BLS menu "Setpoints"

The "Setpoints" menu is used to configure the operating behaviour of the base load sequencing. The following sub-menus are available: The display can be scrolled using the arrow keys to permit display of other points.

p1 Cut-Out Point
Maximum line pressure at which the BLS will shut down the compressor on the far right in the sequence.

p1 Cut-In Point
Minimum line pressure at which the BLS will activated the next available compressor.

p2 Cut-Out Point
Maximum line pressure in pressure band p2 at which the BLS will shut down the compressor on the far right in the sequence.

p2 Cut-In Point
Minimum line pressure in pressure band p2 at which the BLS will activated the next available compressor.

Timer Control Enabled On/Off
Enables the scheduled BLS timer Start/Stop settings to start or stop the whole BLS group, e.g. at the weekend.

p2 Timer Enabled On/Off
Activates the programmed settings of the BLS timer control for pressure band p2, in order to activate the second pressure band for the BLS.

Behaviour

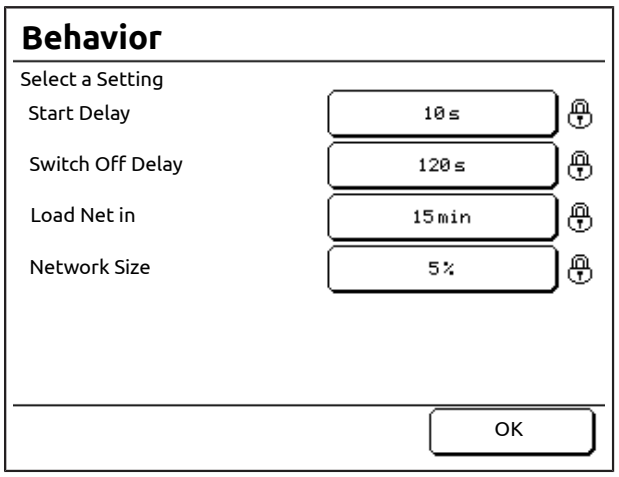


Fig. 10-10: BLS menu "Behavior"

NOTE

This menu must be enabled via the code for the "Maintenance level" to be able to make changes to the settings.

In this menu, the operating behaviour of the BLS group can be matched to the operating conditions.

Start delay
If the minimum line pressure is undershot (pressure demand), the first compressor is switched on immediately, the next compressor is however only switched on once the programmed start delay has elapsed. A staggered start ensures a more gradual increase in load on the local power supply.

Switch Off Delay (**RS**)
When the master determines that the compressed-air requirement in the network has dropped sufficiently to allow for a slave to be switched off, a delay time (the so-called Switch Off Delay) is activated. If the compressed-air requirement stays low during this delay time, the extreme right slave in the BLS sequence is switched off and the remaining compressors meet the compressed-air requirement.
If the compressed-air requirement increases again before the scheduled switch off delay has elapsed, the slave will not be shut down. This is designed to prevent unnecessary compressor starts and stops.

Load Net in
If the BLS is activated manually or by the scheduled BLS timer, the compressed air network will be loaded within the set time by activating only as many compressors as required to load in the compressed air network within that time; the shorter this time has been set to, the more compressors are switched on.

Network Size
The master controller utilises this value as a factor to perform calculations while the line pressure is within the pressure band. This value should only be modified in the event of significant fluctuations in the compressed air requirement.

The value is used to calculate how many compressors must be switched on (or off) to match the increase (or decrease) in the line pressure.

If the line pressure drops and the controller calculates that, for example, more than two compressors will be needed to meet the current compressed-air requirement, one or more compressors will be started up immediately as a precaution, instead of waiting until the minimum line pressure is reached. The same happens in reverse in case of an increase of line pressure.

If too great a network size is entered, the controller will activate (or shut down) more compressors than necessary to counter the pressure decrease (or increase). Only modify the default value in case of significant fluctuations in the compressed-air requirement.

Enter a percentage "a" based on a ratio of network volume to the total available delivery volume flow of the group, calculated based on the following formula:

$a = (100 * b) / c$

where

a = network size (%)

b = network volume size (m^3)

c = total delivery volume (m^3/min)

NOTE

The network volume size "b" should only be equivalent to the volume of the compressed-air tank closest to the compressor group. All pipework and any other compressed-air tanks which may be installed further along the compressed air network should be ignored.

If you have any questions, contact Gardner Denver.

Configuration

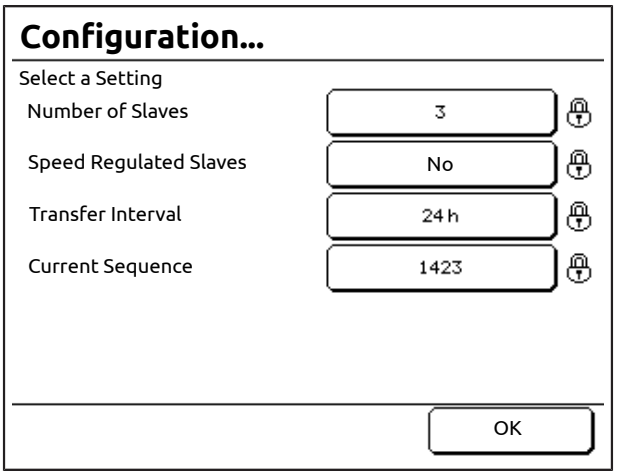


Fig. 10-11: BLS menu "Configuration..."

NOTE

This menu must be enabled via the code for the "Maintenance level" to be able to make changes to the settings.

Slaves can be configured and settings for the BLS sequence made in this menu.

Number of Slaves
Key in the number of slaves connected to the master.

Speed Regulated Slaves "Yes" / "No" (**RS**)
Select here whether the slaves are speed-controlled or not.

Transfer Interval
Use this area to define the time interval at which the sequence is reconstructed on the basis of the operating hours (BLS) of the compressor. The transfer can be disabled by keying in 0 hours.

Current Sequence
The sequence can be defined manually, e.g. for test purposes, or if a specific sequence is to run continuously. To do so, set the transfer interval to "0 h".

Timer Control

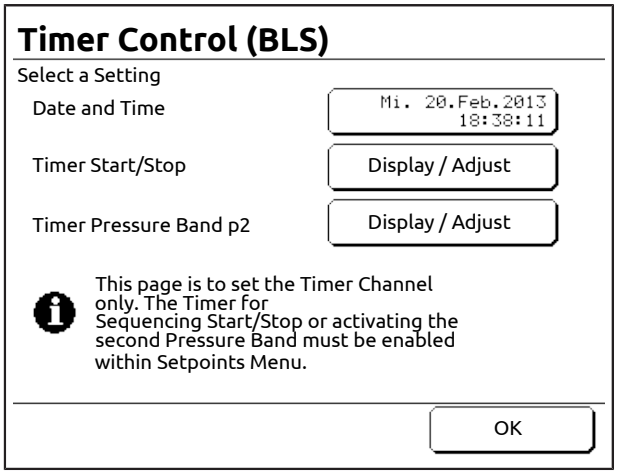


Fig. 10-12: BLS menu "Timer Control (BLS)"

The settings for timer control operation can be made in the menu "Timer Control (BLS)".

The following sub-menus are available:

- "Timer Start/Stop"; to configure timer control operation for the BLS group. See chapter "Configuration / Timer Control Operation".
- "Timer Pressure Band p2"; to configure timer control operation for the BLS group in the second pressure band. See chapter "Configuration / Timer Control Operation".

The timer control for switching the BLS group on / off or for activating the p2 pressure band must be activated in the BLS menu "Setpoints".

A BLS group, which has been switched off by the timer control, can be switched on via a programmable input. See chapter "Configuration / Programmable Inputs / Override Timer Start".

The pressure band p2 can likewise be activated via a programmable input. See chapter "Configuration / Programmable Inputs / Pressure Band p2".

10.7 BLS function description

Control Algorithm

As long as the BLS is manually switched off, the slaves will run independently from the master using their local setpoints.

If BLS is activated manually or via the programmed BLS timer control, the network is pressurised within a set period ("Load Net in"). Accordingly only as many compressors as are required to pressurise the network with compressed air within that time are switched on. After a power failure, this function is not activated, because in this case it is essential for the net to be pressurised with compressed air as soon as possible.

In the event of a line pressure sensor fault (Fault E406:Sensor B1 (Line Press.)), the master can no longer control the group and shuts off the BLS until the fault is removed and reset. If the master compressor shuts down because of a fault other than a line pressure sensor fault, or if it is shut down manually, the master will continue to control the base load sequencing with the remaining slaves.

Once the line pressure exceeds the defined maximum line pressure, the compressor at the far right in the sequence will be shut down. As long as the maximum line pressure is exceeded, the system will continue to shut down further compressors consecutively in short time intervals.

If the line pressure drops below the defined minimum line pressure, the next available compressor will be started up immediately, followed by more compressors in a set period of time ("Start delay") if the line pressure remains low.

RS-Master - FS-Slaves: The speed-controlled compressor regulates the line pressure within the available speed range, to be exactly between the minimum and the maximum line pressure. If the pressure band limits are reached, compressors are started up and shut down as described above.

RS-Master - RS-Slaves: Speed-regulated compressors will run approximately at the same rotational speed and load if their size is approximately the same. After a manual restart of a compressor (e.g. after service), the speed may be temporarily asynchronous until the compressor achieves its minimum or maximum speed limit.

Specification of a new Sequence based on hours run (BLS)

Once the transfer interval period has elapsed, the BLS master establishes a new sequence order on the basis of the Operating hours (BLS) of the compressors. The compressor with the lowest Operating hours (BLS) is placed in first position in the sequence and so on.

RS-Master - FS-Slaves: The speed-regulated compressor will always stay in first position, whereas the fixed-speed slaves will have their sequence order changed periodically.

The freely adjustable Operating hours (BLS) counters can be used to manipulate the sequence if necessary, for example if a new compressor is installed alongside older ones. See the following examples.

Example 1

	Compressor 1	Compressor 2
Hours Run (actual)	1000 h	1 h
Operating hours (BLS)	1000 h	1h

Chart 10-7: Example 1

Operating hours (BLS) are set to the same figure as the actual operating hours. The new Compressor 2 will run in the base load position for about 1000 h, as it has the lowest Operating hours (BLS). Afterwards, both compressors alternate in sequence.

Example 2

	Compressor 1	Compressor 2
Hours Run (actual)	1000 h	1 h
Operating hours (BLS)	1000 h	1000 h

Chart 10-8: Example 2

The Operating hours (BLS) were modified to integrate Compressor 2 and the alternating sequence for the two compressors starts immediately.

10.8 Trend and statistics graphs

Additional graphs when base load sequencing is activated

If base load sequencing is activated, the following graph screens are additionally available in the menu "Trends":

- Volume Flow (BLS)
- Statistics Weekly Profile (BLS)

Volume Flow (BLS)

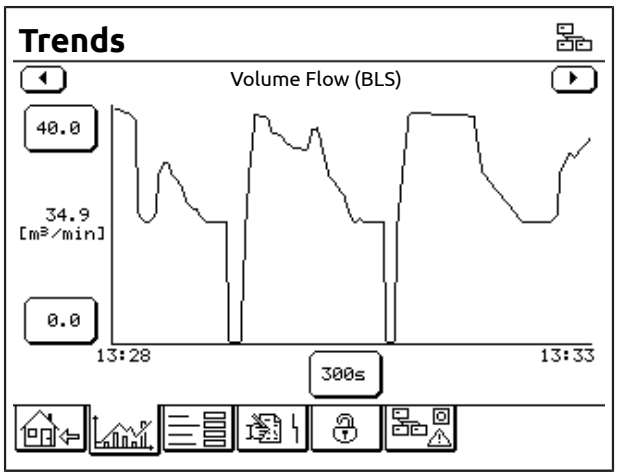


Fig. 10-13: Graph screen "Volume Flow (BLS)"

This graph shows the variation in the volume flow of the base load sequencing group over a specified period.

Statistics Weekly Profile (BLS)

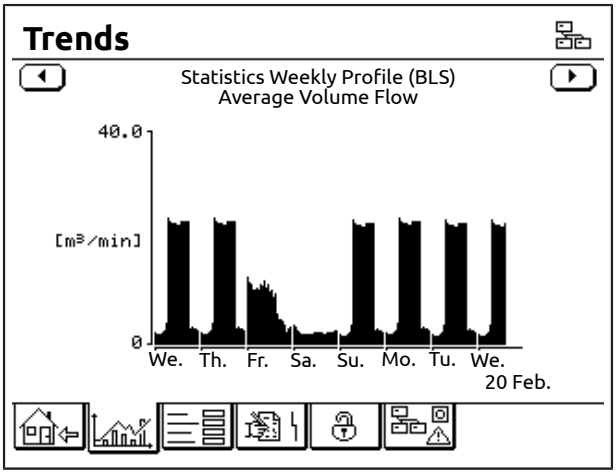


Fig. 10-14: Graph "Statistics Weekly Profile (BLS)"

This bar graph shows the average hourly volume flow of the base load sequencing group over the last 8-days.

10.9 RS485:3 module installation

This chapter explains how to retrofit the RS485:3 module if it has not already been installed in the controller ex-factory. If the module is already installed, the "X08" connector will be visible at the back of the controller.

The RS485:3 module extends the controller by the addition of a third RS485 interface.

Ordering information:

- Part number: ZS1075506
- Scope of supply:
  - RS485:3 module
  - Connector kit for slave controllers
  - Installation manual for the RS485:3 module

Installation

NOTE

To install the RS485:3 module also observe the installation manual for the RS485:3 module.

DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

⇨ With the speed-controlled types (**ARV**) there is a risk of electric shocks due to charged capacitors! Isolate the compressor and wait 10 minutes before touching any electrical parts.

⇨ Check the DC bus voltage. (**Only applicable for Allen Bradley frequency converter**)

1 Switch the main switch OFF
2 Open the switch cabinet door and swing sufficiently open.
3 Disconnect all connections from the controller.
4 Take off the controller cover.
5 Plug the RS485:3 module into the provided sockets.
6 Ensure that all pins are in the socket and not beside it.
7 Close the controller cover.
8 Make all connections to the controller.
9 Close the switch cabinet door.

Wiring Method

We strongly recommend that you use shielded and twisted pair (TP) cables (types 2 x 2 x 0.25 to 0.75 mm^2).

Total bus wiring length must not exceed 1200 m.

The RS485 interfaces of the master and the slave compressor controllers should form a bus structure, i.e. all compressors should be connected in series.

The following image shows examples of correct and incorrect wiring of the compressor station.

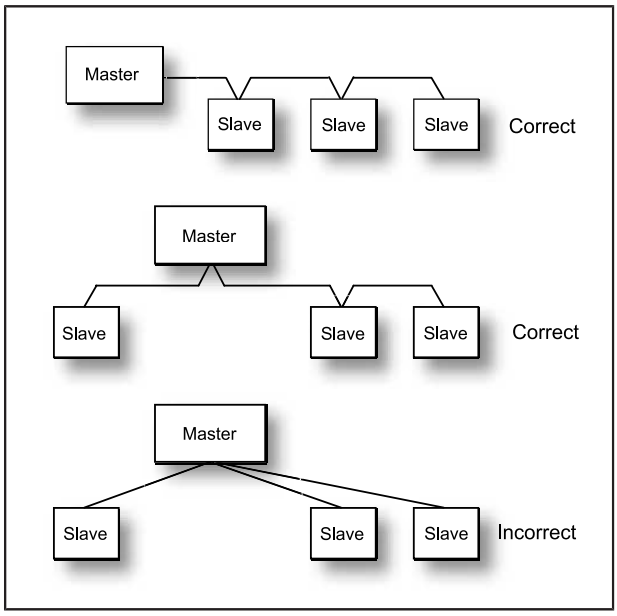


Fig. 10-15: Wiring the compressors

Circuit diagram

During installation, refer to the terminal numbers shown on the appropriate connector only, i.e. not to any other marking on the slaves. The following image shows examples of all supported hardware models. The DELCOS XL Master can control up to a maximum of 3 slaves.

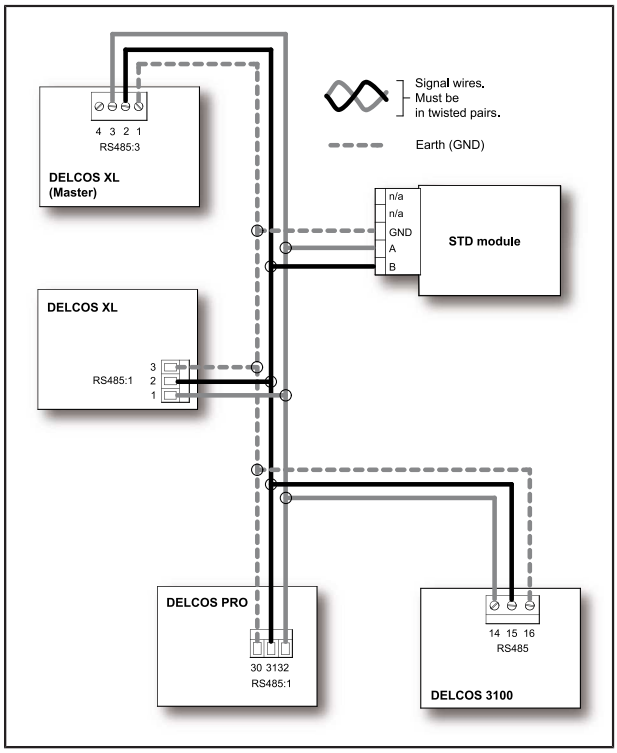


Fig. 10-16: Circuit diagram

Set Up the Slave Compressor Controller Communication Parameter

The appropriate minimum required software version must be installed on the controllers in order for them to operate correctly. See table "Required software versions".

Set the communications parameters on the slave controllers as follows:

1. Set the RS485 protocol to ModBus. See operating instructions for slave control.
2. Set the slave baudrate to "9600". See operating instructions for slave control.
3. Set the RS485 address of the slave. See operating instructions for slave control.
   The necessary RS485 address is indicated on the button <Compressor> in the menu "Base Load Sequencing (BLS)".

NOTE

The STD module is configured using DIP switches. See the following chapter.

10.10 Installing the compressor module (STD)

DANGER

Electric shock

Life-threatening electric shock

⇨ Work on the electrical equipment must only be carried out by authorised electricians or electrical technicians.

General

The compressor module (STD) is used to connect any other controller such as the DELCOS XL, DELCOS PRO or DELCOS 3100 to the DELCOS XL Master. The module is connected to the master via the integrated RS485 interface.

The status of the compressor is detected by digital inputs of the compressor module and sent to the master via its RS485 interface.

In addition, commands for the control of the compressor are transmitted from the master to the compressor module (STD) via the RS485 interface and are executed by the digital outputs.

Ordering information:

- Part number: 100016166
- Scope of supply:
  - Compressor module (STD)
  - RS485 connector

Technical Specification

Item	Value
Supply voltage	110..230 V AC/DC ±10 %
Power consumption	1 VA
Digital inputs	24..230 V AC/DC ±10 %
Digital outputs	Potential-free relay outputs, max. 240 V AC / 1 A
Ambient temperature	Operation 0 to 55 °C Storage -25 to +75 °C
Dimensions (W x H x D)	100 x 110 x 70 mm
Type of protection	IP30
Assembly	DIN rail TS35

Chart 10-9: Technical Specification

Setting the address of the compressor module (STD)

NOTE

The DIP switches should be set prior to installation of the compressor module (STD) in the switch cabinet.

The DIP switches are located behind a cover on the right hand side of the module.

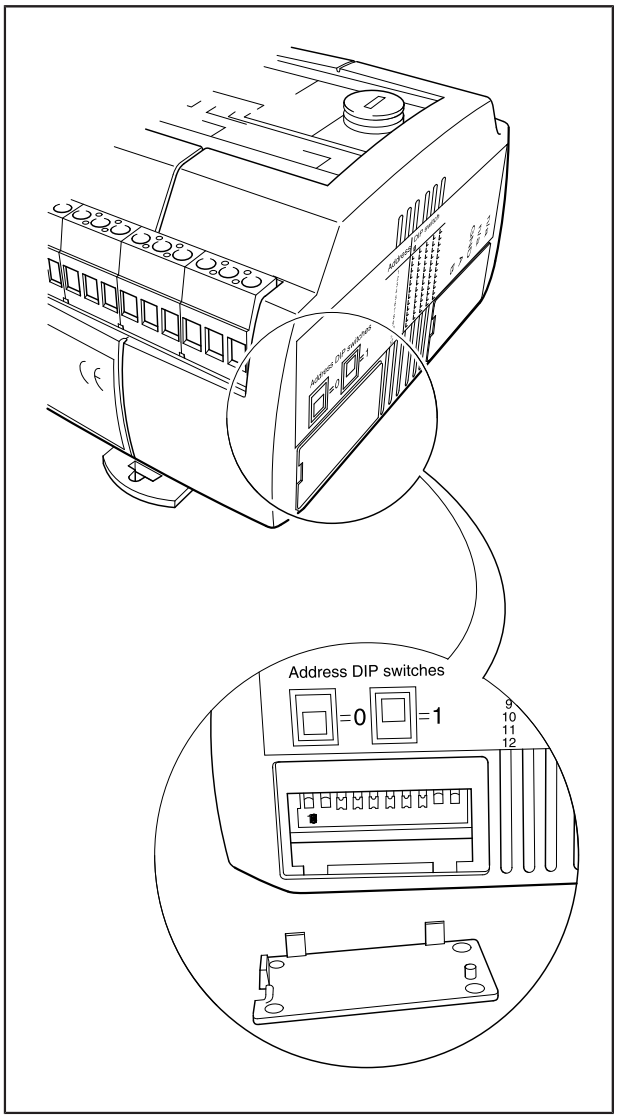


Fig. 10-17: Position of the DIP switch

The following table shows the necessary and valid DIP switch settings for communicating with the DELCOS XL Master:

Address	DIP switch									
	1	2	3	4	5	6	7	8	9	10
2	0	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	0

Chart 10-10: Compressor module (STD) DIP Switch Settings

1 = On (up)

2 = Off (down)

Fitting and installation:

The fitting and installation of the compressor module (STD) takes place according to the local circumstances and must be undertaken by an electrician.

NOTE

The connection of the compressor module (STD) shown in these operating instructions is suitable for the majority of compressor controllers.

In these operating instructions, only the function of the compressor module (STD can be described), not however the detailed installation in any particular compressor module (third part manufacturer). The fitting and functional implementation must be carried out using the respective compressor documentation and, where necessary, after consultation with the compressor manufacturer.

Digital inputs

NOTICE

Material damage

When a compressor module (STD) is installed, the compressor's pressure switch can, under certain circumstances, no longer provide over-pressure protection.

⇨ For compressors that are not equipped with independent over-pressure detection, we recommend that a pressure switch be incorporated in the compressor fault circuit(s) to ensure that any local over-pressure condition will stop the compressor independently from the DELCOS XL Master.

The module detects the compressor status via three digital inputs, which are indicated via three LEDs on the module. Each input may be connected to voltage of the range of 24 to 230 V AC or DC.

Each input has three terminals:

- 24 to 48 V UC terminal
- 110 to 230 V UC terminal
- COM terminal

The signal voltage used must be forwarded to the corresponding connection.

Digital input "Operating"

A signal must be connected to this input to indicate that the compressor is ready to produce compressed air after sending a remote load signal.

For compressor controls which do not have such signal, the input can be connected to the collective fault signal of the compressor.
This signals the DELCOS XL Master that there is no fault at the compressor.

Digital input "Motor"

Contacts A1 and A2 of a main contactor coil can be connected directly to this input.

If the compressor controller energises the coil of the main contactor, the compressor module detects the voltage over the coil and notifies the master that the motor is running.

For compressor controllers without a main contactor, any output can be used which indicates that the motor is running, e.g. a fan contactor or a soft starter signal.

Digital input "On-Load"

The regulation valve coil can be connected directly to this input.

If the compressor controller energises the coil of the regulation valve, the compressor module detects the voltage over the coil and notifies the master that the motor is on load.

Any output which indicates that the compressor is on load could also be used.

Digital outputs

Digital outputs

NOTICE

Material damage

When a compressor module (STD) is installed, the compressor's pressure switch can, under certain circumstances, no longer provide over-pressure protection.

⇨ For compressors that are not equipped with independent over-pressure detection, we recommend that a pressure switch be incorporated in the compressor fault circuit(s) to ensure that any local over-pressure condition will stop the compressor independently from the DELCOS XL Master.

The compressor is controlled by two or three digital outputs. The status of these outputs is indicated via three LEDs.

These digital outputs are change-over contacts and can be adapted to the requirements of the compressor controller by selecting the appropriate terminals.

Digital output "Remote load enabled"

Do not use this output to switch the compressor on and off.

This output should cause a change-over from internal regulation to control via the digital outputs of the compressor module.

Digital output "Remote load"

Do not use this output to switch the compressor on and off.

This output switches the compressor on load. This remote load signal should be active when the "Remote load enabled" output is sent to the compressor controller.

Digital output "Remote half-load"

This output is not used for this application.

Connection allocation and connection examples

Connection allocation

Port	Function	
6	Digital input "Operating"	COM
7		110...230 V UC
8		24...48 V UC
9	Digital input "Motor"	COM
10		110...230 V UC
11		24...48 V UC
12	Digital input "On-Load"	COM
13		110...230 V UC
14		24...48 V UC
16	Power supply 110...230 V AC/DC (±)10%	(~) (+)
17		(~) (-)
21	Digital output "Remote load enabled"	COM
22		NC
23		NO
26	Digital output "Remote load"	COM
27		NC
28		NO
31	Digital output "Remote half-load"	COM
32		NC
33		NO

Chart 10-11: Connection allocation

Compressor Status Messages

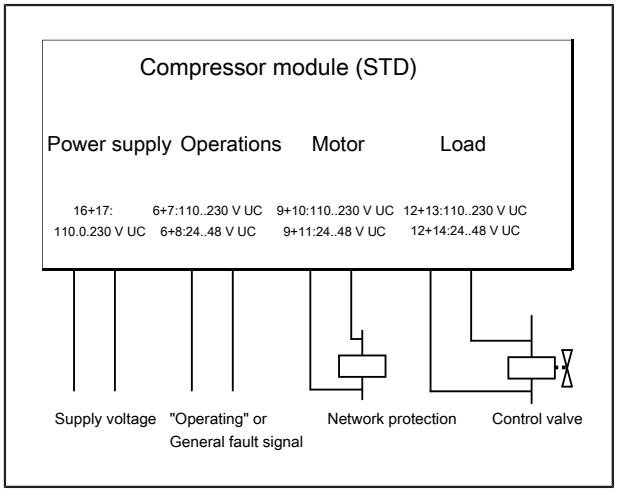


Fig. 10-18: Connections for status messages

Controlling a compressor with line pressure sensor and electronic compressor controller (example)

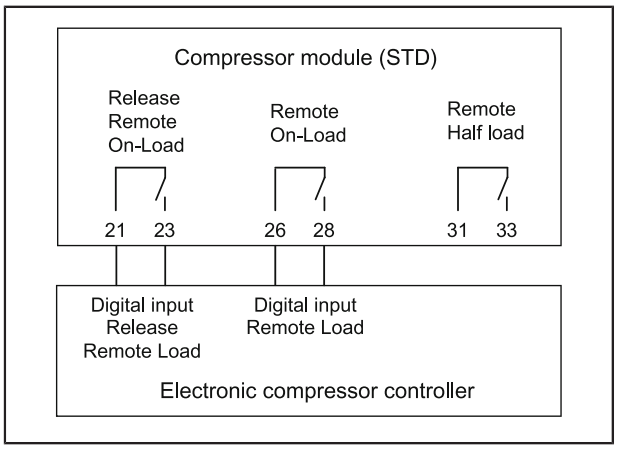


Fig. 10-19: Line pressure sensor and electronic compressor controller

Controlling a compressor with line pressure switch (example)

NOTICE

Material damage

When a compressor module (STD) is installed, the compressor's pressure switch can, under certain circumstances, no longer provide over-pressure protection.

⇨ For compressors that are not equipped with independent over-pressure detection, we recommend that a pressure switch be incorporated in the compressor fault circuit(s) to ensure that any local over-pressure condition will stop the compressor independently from the DELCOS XL Master.

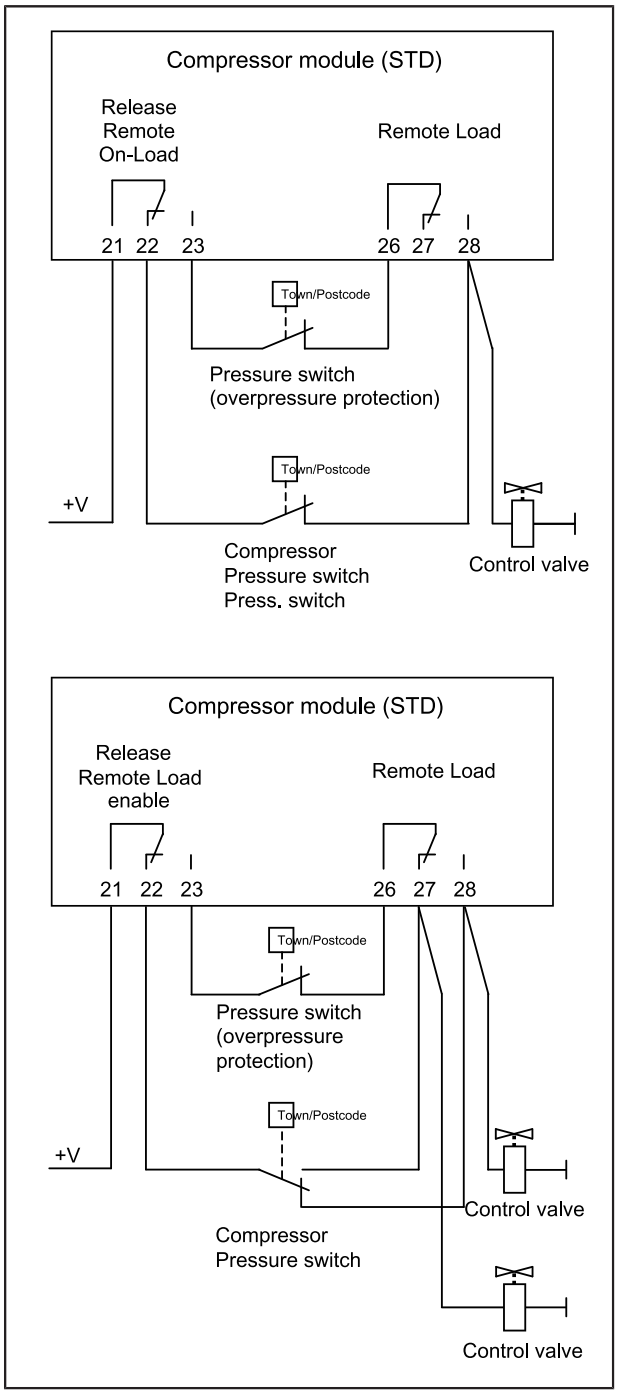


Fig. 10-20: Line pressure switch - control

11 APPENDIX

11.1 Status messages

Display	Explanation
Fault <Fault number>:<Fault text>	A fault has been detected, the compressor has been switched off. See the "Troubleshooting" chapter.
Ready to Start	The compressor is ready to start.
Motor Starting...	The drive motor is currently starting.
Stopping Procedure "x" s	The Soft Stop procedure is currently running and will complete in “x” seconds.
On-load "x" rpm (min)	(**RS**) The compressor is running on-load at "x" rpm. denotes motor is currently running at allowed minimum speed).
On-load "x" rpm	(**RS**) The compressor is running on-load at "x" rpm.
On-Load "x" rpm (max)	(**RS**) The compressor is running on-load at "x" rpm. (Max. denotes motor is currently running at allowed maximum speed).
On-Load	(**FS**) The compressor is running on-load.
Off-Load "xxx" rpm	(**RS**) The compressor is currently off-load in continuous operation at allowed minimum speed.
Off-Load	(**FS**) The Compressor is currently running off-load in continuous operation.
Off-load run-on time "x" s	(**FS**) The run-on timer has been activated and the compressor will switch to stand-by mode in "x" seconds.
Off-load "xxx" rpm run-on time "x" s	(**RS**) The run-on timer has been activated and the compressor will switch to stand-by mode in "x" seconds.
Attention: Start by remote control...	Attention: This Compressor can start up at any time via remote control.
Attention: Start by timer control on <Day of the Week> at <Time> ...	Attention: The compressor will automatically start via the timer control at the week day and time shown.
Attention: Start on ?? at ??:??.	This message (including all the “????”) will appear if there is no valid timer schedule programmed (all 8 channels are “Off”). This means the compressor will never start. Check the settings in the "Timer Control" menu.
Attention: Start upon pressure demand...	Attention: This Compressor will automatically start up as soon as there is a pressure demand on the network.
Attention: Start after De-Pressurise...	Attention: The compressor will automatically start up as soon as the internal pressure in the screw compressor stage has dropped below Start Protection value.

Chart 11-1: Status messages

Display	Explanation
Attention: Start after external start request approval...	If a programmable input with the function "Start Requ. Approval" has been activated, the compressor starts as soon as the expected enable has been granted at this input.
Attention: Starting in "x" s after Power Loss…	Attention: This Compressor has experienced a power loss. It will automatically restart in “x” seconds.
Attention: Starting in "x" min after Dryer Pre-Run Time…	Attention: This Compressor will automatically start as soon as the Dryer Pre-run time has elapsed.
Initialising VSD...	(**RS** + **ARV**) The converter is initialised.
Parameterizing VSD (x %)…	(**RS** + **ARV**) Parameters are being sent to set up the converter.

Chart 11-1: Status messages

11.2 Settings

Compressor Data

The compressor reference number and the setup codes can be entered in this table.

Compressor identification number	
The setup code	

Chart 11-2: Compressor Data

Adjustment values

The adjustment values from the "Settings" menu can be entered in this table.

Parameters	Number / Setting
Hour Meters	
Hours Run	
Hours On-load	
Hours to next Service	
Control	
p1 Cut-Out Point	
p1 Cut-In Point (**FS**) / p1 Target Pressure (**RS**)	
p2 Cut-Out Point	
p2 Cut-In Point (**FS**) / p2 Target Pressure (**RS**)	
Operating mode	
Remote Start Enabled	

Chart 11-3: Adjustment values

Parameters	Number / Setting
Timer start enabled	
p2 Timer Enabled	
Automatic re-start	
- Max. Power Loss Time	
- Restart Delay	
Dryer Pre-Run Time	
Timer Start/Stop	
Channel 1	
Channel 2	
Channel 3	
Channel 4	
Channel 5	
Channel 6	
Channel 7	
Channel 8	
Timer Pressure Band p2	
Channel 1	
Channel 2	
Channel 3	
Channel 4	
Channel 5	
Channel 6	
Channel 7	

Chart 11-3: Adjustment values

Parameters	Number / Setting
Channel 8	
Programmable Inputs and Outputs	
Input 1	
Input 2	
Input 3	
Input 4	
Input 5	
Output 1	
Output 2	
Output 3	
Output 4	
Communication	
RS485:1 Address	
RS485:1 Baudrate	
RS485:3 Address	
RS485:3 Baudrate	
Configuration	
Language	
Temperature Unit	
Pressure Unit	
Volume Flow Unit	
Maximum Volume Flow	
Minimum Volume Flow (**RS**)	
Ext. Speed Limit (min) (**RS**)	
Ext. Speed Limit (max) (**RS**)	
Factory Settings	
Operating pressure	
Start Requ. Approval	
Heavy Startup (**FS**)	
Discharge Temp. Warning	
Discharge Temp. Fault	
Start temperature min.	

Chart 11-3: Adjustment values

Parameters	Number / Setting
Discharge Temp. Control	
Run-On Time	
Soft Stop Time	
Star-Delta (**FS**)	
Cooling Control (not on **ARV**)	
Software version	
Controller Ref.-No.	
Base Load Sequencing	
Setpoints	
p1 Cut-Out Point	
p1 Cut-In Point	
p2 Cut-Out Point	
p2 Cut-In Point	
Timer Start Enabled	
p2 Timer Enabled	
Behaviour	
Start delay	
Load Net in	
Network Size	
Timer Control	
Channel 1	
Channel 2	
Channel 3	
Channel 4	
Channel 5	
Channel 6	
Channel 7	
Channel 8	
Configuration	
Number of Slaves	
Transfer Interval	

Chart 11-3: Adjustment values

Version dependent, see the compressor operating instructions

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