User's manual

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1 Introduction

Thank you for buying ARCHON – system for intelligent control of compressor stations. ARCHON system is fully modular and that is why there can be parts of this manual which do not refer to your specific installation.

Following labels are used in the text:

⚠ Warning

Instructions labeled as Warning must be followed. Otherwise it can cause damage to the installed device or user's health.

⚠ Important

This section contains instructions vital for proper functioning of the device. If not followed damage to the device may occur.

✎ Note

Notes contain various additional information.

2 Storage and installation

2.1 Storage of the system

ARCHON system does not require any specific treatment during long term storage but respect the working temperature stated in technical parameters section and store the system in low humidity and low dust environment.

Long term storage probably erases settings of the system and that is why the settings should be renewed after the reconnection.

2.2 Installation of the system

ARCHON system is not designed to be installed by customers. Installation must be performed by a qualified electrician trained by the manufacturer.

⚠ Warning

The controller must be installed by a qualified electrician.

Before the installation check the machine specification (esp. power supply) and completeness of the delivery.

⚠ Warning

The controller is designed for various voltage and its connection to the wrong power source can cause permanent damage to the machine.

During the installation strictly separate high voltage devices and those which generate high EMC interference from all electronics. The system must be installed in well ventilated environment. Lower working temperature to prolongate life span of the device.

Do not place signal cables (RS485, digital inputs/outputs, sensor cables) along power cables.

⚠ Important

Electrostatic discharge can cause permanent damage to the machine. Pay attention to correct earthing when connecting the machine.

The controller must be installed directly to the wall vertically. Use all mounting points to install the controller. After mounting the machine to the wall connect all inlet and outlet clamps according to the attached

diagram. The power supply can be turned on only when the door of the machine is secured. After switching the machine on it is necessary to set the system according to the instructions in Chapter 4.

3 System control

The control system initializes automatically after switching on. Home page containing basic parameters of the compressor station and each connected compressor is launched. Return to the home page by pressing *F1 button*.

Advanced version home page is shown in *figure 3.1*.

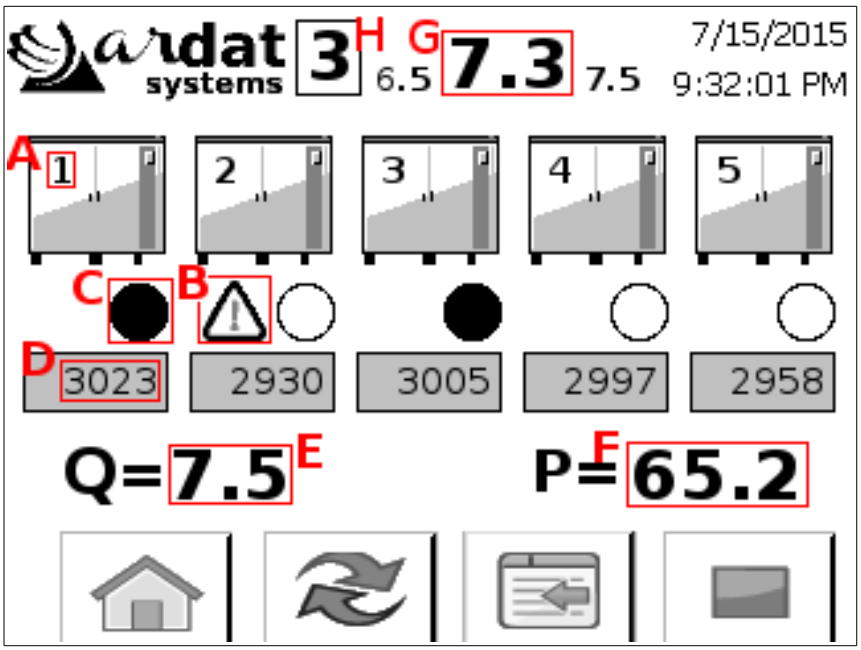


Fig. 3.1 Home page (ARCHON Advanced)

The home page shows following data:

- A priority of each compressor,
- B indicator of a compressor malfunction (visible only when a malfunction occurs),
- C compressor running indicator,
- D running time of a compressor,
- E flow sensor data (if the sensor is installed),
- F power sensor data (if the sensor is installed),
- G working pressure from the compressor station,
- H active schedule.

If flow and/or power sensors are not installed, their values are computed from nominal parameters of compressors/pressure system. The FAD is computed from system volume, pressure difference and compressors performance.

3.1 Basic control instructions

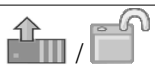
Control diagram for Advanced system is shown in fig. 3.2. Return to the homepage by pressing

Advanced:	the symbol on the touch panel (or *F1 – HOME/SET* button),
Basic:	*F1* button.

Move to the next page by pressing

Advanced:	the symbol on the touch panel (*F2 – PAGE* button),
Basic:	an *Fx* button, where *x* equals the page number.

System for remote control of compressors is switched ON/OFF by pressing

Advanced:	 symbol on the touch panel (*F3 – AUTO/MAN* button),
Basic:	*F9* button.

If the system is set to automatic mode, compressors are controlled by ARCHON only. In manual mode the compressors switch to autonomous operation, once the ARCHON control is switched off, so each compressor starts and stops according to its control algorithm.

ARCHON control is switched on/off by pressing

Advanced:	▶/■ symbol on the touch panel (*F4 button – START/STOP*),
Basic:	*F10 button.*

When switched on, ARCHON takes over control of compressors (even if remote control is off) and starts and stops compressors automatically according to set priorities. When the control system is switched off, the compressors are unloaded and stopped according to their settings.

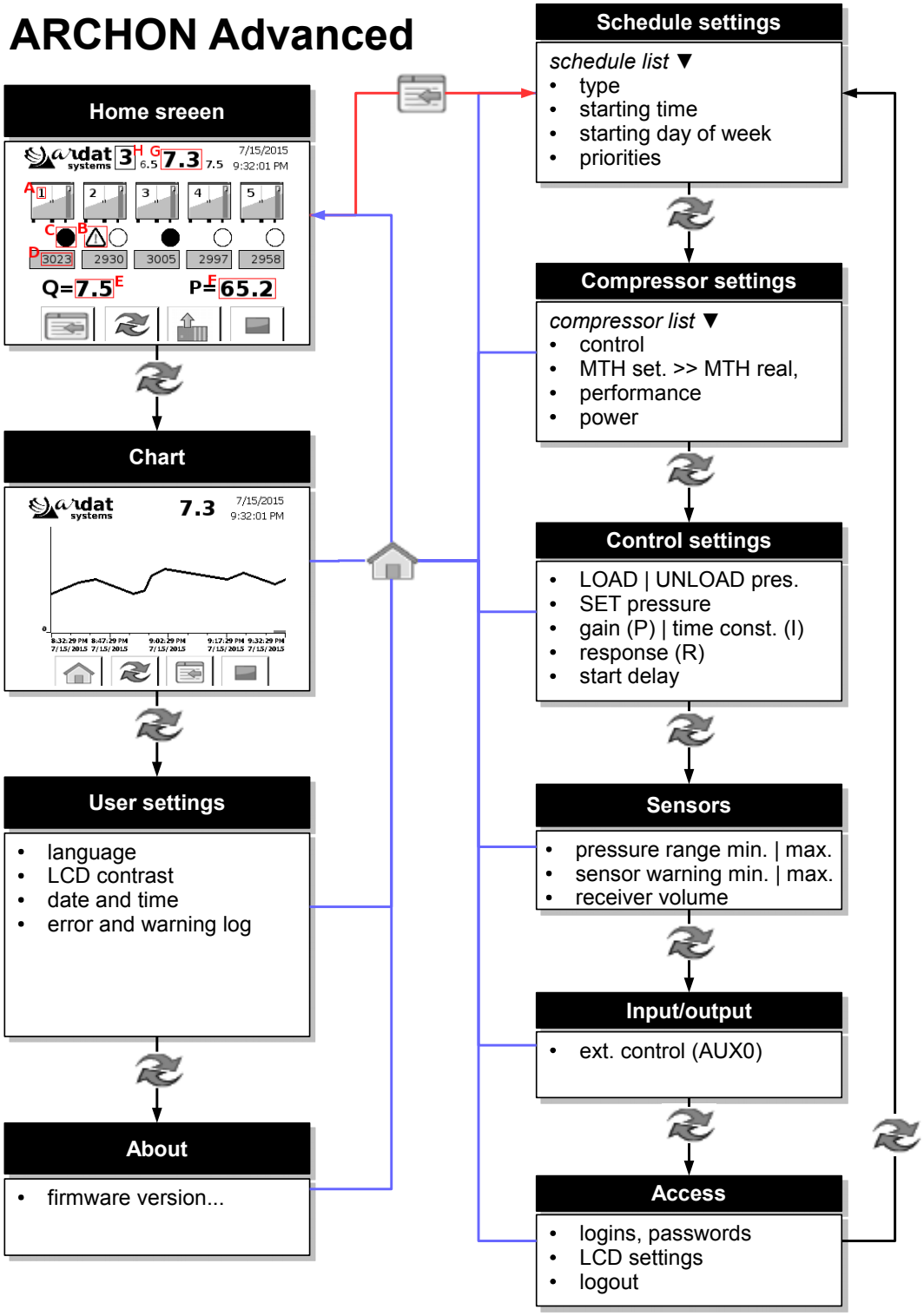


Fig. 3.2: ARCHON Advanced control diagram

3.2 User section description

Screen 2 shows outlet pressure chart, see figure *3.3*. The chart is being updated periodically.

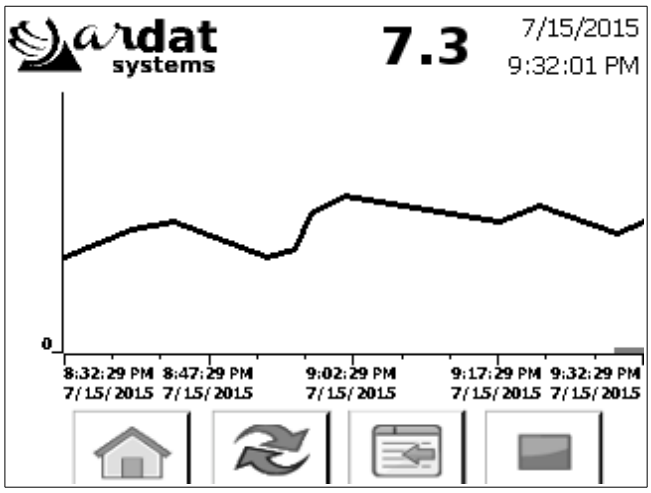


Fig. 3.3: Screen 2 – outlet pressure chart

Screen 3 shows user settings. It is possible to set the touch panel language, adjust contrast and set system time and date. You can find the warning and error history in the lower part of the screen.

Basic information about the software version and current system configuration are displayed on *screen 4*.

4 System settings

The system can be set in a special menu which is not accessible for users. To enter this special section switch to the home page by pressing *F1* button and

Advanced:	*F1 button – HOME/SET* or on touch panel,
Basic:	*F5* button*, buttons F6* and *F7* are used as page up and page down.

If no user name and password were entered, you will be asked to enter them. The default values are:

User name:	admin	user
Password:	archon	user

After the password is entered it is possible to open the settings menu by pressing the settings button once again. Use the same buttons to move within the settings menu as in user menu. Settings menu contains following screens:

- schedule settings,
- compressor settings,
- control settings,
- sensor settings,
- access control settings.

Some settings are available only for administrator (esp. sensor settings, user accounts etc.). If higher access level is needed, you will be asked to enter the password again. Each part of the menu is described in the following paragraphs.

4.1 Schedule settings

ARCHON is able to work in several modes of compressor priorities settings. The proper priority settings reduces running and maintenance costs of the compressors by tens of percents. The optimal settings is application specific. It is recommended to combine several strategies and perform an energetic audit to maximize the advantage of each strategy.

Priority means the order of each compressor – the compressor with priority 1 will be started as first, the compressor with priority 2 will be started as 2nd, etc.

You can choose schedule 1 to 10 on the *schedule* screen. The settings of the selected schedule will be displayed bellow. Each time schedule contains

- *schedule type* – or compressor control strategy; once the schedule is activated, the priorities are initialized according to the selected strategy (see bellow),
- *time of schedule activation* – time and day(s) of week, when the schedule should be activated, the schedule is active until next schedule is activated,
- *priority list* – input compressor number (1 for A, 2 for B, etc.) into each field, the compressors will receives priorities from left to right, if 0 is written into the field, it is ignored (so some compressors can be completely turned off).

All changes will be performed once the given schedule is activated. If you want to force the schedule update immediately press UPD button; the current schedule settings will be applied.

4.1.1 Schedule off (OFF)

The schedule can be switched off. In such case, all other schedule settings will be ignored and next schedule will be activated.

> ✎ **Note**
>
> Switching off the schedule does not mean switching off the compressor station. To switch off the compressor station, follow paragraph 4.1.4.

4.1.2 Fixed priorities (PRI)

Fixed priorities can be set to all compressors. This option is most suitable for compressor stations with different type of compressors, can be used

a) when an energetic audit was performed and priorities are based on compressor performance/efficiency and estimated compressed air consumption in given period, or

b) when fixed order of compressors is needed because of technology reasons.

> ✎ **Note**
>
> If variable speed compressors are installed, it is usually preferred to set highest priority to these compressors., so they can be used for precise control from the beginning of the sequence.

4.1.3 Uniform load (MTH)

Once the schedule is activated, the compressors are sorted according to service hours (MTH), so the compressors with less MTH have higher priority. This leads to uniform load of the compressor station and synchronizes maintenance intervals for all compressors and thus reduces the service costs.

The priority list serves as enabled compressor list. If you want to disable some of the compressors, enter zeros into the list.

4.1.4 Switching the compressor station off

If you need to switch off the compressor station completely at given time, use the fixed priority schedule and enter zero to all the priority fields.

4.2 Compressor setting

Choose a compressor from list – all the parameters will be updated. You can set following parameters of the compressor:

- *control type* – load/unload or variable speed drive (frequency inverter),
- *motohours* – service hours of the compressor, left field can be used for adjustment (if the compressors MTH are not even) and right field displayed the set value, >> button can be used to update the motohours,

✎ Note

If the compressor bus is compatible with ARCHON, the MTH are directly read from the compressor controller. Otherwise, adjust the MTH to the compressor controller manually during the service check.

- *performance* – nominal FAD of the compressor, is used for FAD calculation,
- *power* – nominal power of the compressor, is used for power calculation,

✎ Note

When not measured, performance and power are only indicative parameters. Variable speed compressors performance and power can not be estimated. If you need more precise data, ARCHON can be equipped with real power and FAD measurement.

4.3 Control settings

Control settings screen contains following parameters:

- *LOAD/UNLOAD pressure* – lower and upper pressure limit for starting/stopping the compressors (the pressure can be entered in *bar* or *psi*, however all units must be the same),
- *SET pressure* – target pressure for control, this value should be between LOAD and UNLOAD,
- *gain (P)* – gain of the PID regulator, this value limits the absolute pressure difference between set value and working pressure (ex. when P = 100 and pressure difference 1 bar, the response will be 100 %),
- *time constant (I)* – integration constant of the PID regulator, this values limits the absolute time, when the pressure can drop (ex. when I = 4 and pressure difference 0.1 bar, the response will reach 100 % after 2 minutes),
- *response (R)* – response threshold, when response meets this value, next compressor is started,
- *starting delay* – minimal delay between two compressor starts (default 10 s), this value is crucial for network overloading protection.

Default parameters are P = 50, I = 2 and R = 100. You can test the system behavior at: http://ardat.cz/archon/web/archon_pid.htm.

4.4 Sensor settings

Pressure sensor range can be set. For 4 – 20 mA sensor, the default settings will be -4.0 bar minimum and 16.0 bar maximum.

If the system contains flow-meter, it can be set here. Otherwise, parameter

- *receiver volume* – represents the volume of the receiver and connected system, this will be used for FAD calculation based on pressure drop/increase.

Two more parameters can be used for warnings.

⚠ Warning

If pressure exceeds the warning range, the system will consider this as an sensor failure and will stop compressor station from security reasons.

4.5 External control settings

Auxiliary input AUX0 can be configured as a remote control. If this settings is activated, LCD start command is ignored and compressor station can be started only via AUX0 signal.

4.6 Access settings, other settings

List of user accounts is displayed in the upper part of the screen. This list can be used to add or remove users and change their passwords or groups (only administrator).

LCD settings button terminates the firmware and runs extended HMI settings. Follow Siemens HMI handbook for detailed description. You can find the last version at http://ardat.cz/archon/v1/SIMATIC_HMI.pdf.

Logout button terminates the settings session and returns back to the *Home* screen. You will be logged out automatically after some period of inactivity.

5 Web interface

ARCHON system can be equipped by a web server for remote monitoring of the compressor station. Default address of the device is *192.168.0.1*. To connect to ARCHON system first set your web interface and then enter

http://192.168.0.1/awp/ARCHON

to your browser. Now you should see the opening screen of the web interface (see fig. 5.1). In the upper part of the screen there is a menu allowing you to change language setting and set hardware of the controller. For further information please read a user's guide of a Siemens controller. You can download the latest version of the user's guide on http://ardat.cz/archon/v1/SIMATIC_S7.pdf.

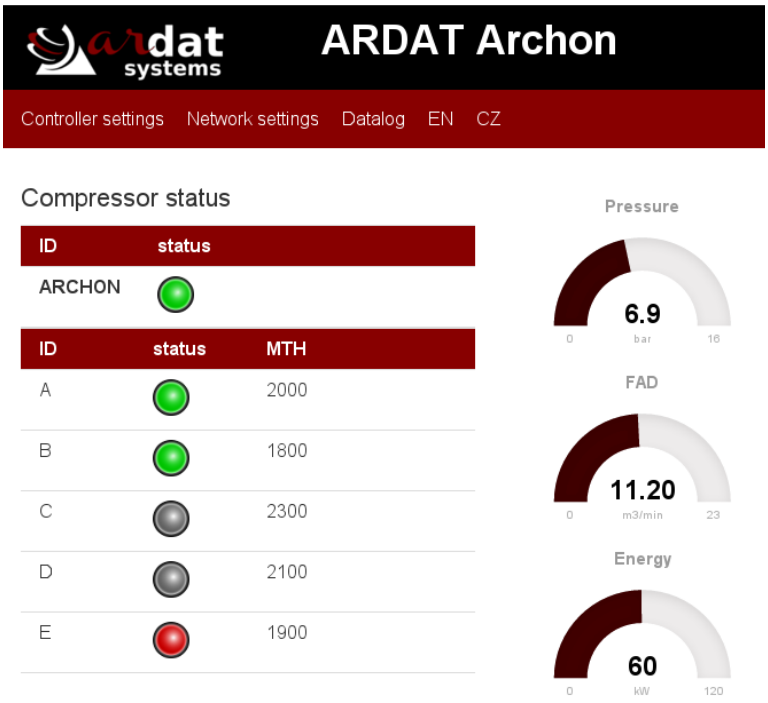


Fig. 5.1: Opening screen of ARCHON web interface

On the left you can see status (green – working, red – failure, grey – ready) and MTH of each compressor. On the right there is an information chart with system parameters (pressure, FAD, power).

5.1 Datalogging

If your system is equipped by a datalogging function, the main menu of the web interface shows a *Recordings* menu. Clicking on it you enter the controller file system, where in *DataLogs* folder you will find *ArchonLog.csv*. It is a CSV file which can be opened in any spreadsheet editor.

The file contains a recording number, date and time (with default period 1 minute), compressor station status, pressure, power and FAD. After reaching its maximum capacity the file starts to overwrite itself. The capacity of the memory card is sufficient for one week recording, the older records are overwritten. The datalogging is active only, when the system control is on.

✎ Note

Data cannot be saved to the controller's memory, use only original memory card.

⚠ Warning

Use only original memory cards provided by the manufacturer. Non-original cards will not be read and they can cause permanent damage to the controller.

5.2 Web address setting

⚠ Warning

The web address can only be changed by a qualified technician. An unqualified intervention can cause non-functioning of the system.

To change the web address, log into the system. After the login click on *Controller setting* and in the left upper part insert your name and password, then you can return to the main screen and choose *Web setting*. Enter the new IP address, subnetwork mask, tick system restart box and confirm *Save*.

⚠ Important

After the IP address change the system will be restarted. The setting page will not be reloaded and you must insert the new IP address to the browser.

⚠ Warning

Before restarting the system (IP address change) make sure all compressors are switched off. The control will be offline during the restart and the compressors may be started automatically.

After changing the IP address it is necessary to update the panel setting. Follow the instructions in the HMI panel user's guide.

⚠ Important

In case of any doubts contact the service center. If you fail while changing the setting, it is possible that communication will not be established and the panel will not work.

6 MODBUS

The ARCHON can be supplied with MODBUS server as an option to communicate with remote system. The MODBUS server is available via TCP or RS485 (MODBUS/RTU). Server listens on port 502, the default device address is 1.

The registers are described in following table.

Register	Length [byte]	Range	Description
0	2	UINT	Compressor state – each bit represents ready signal of one compressor (MSB = compressor A), 1 = compressor ready, 0 = compressor not ready.
1	2	UINT	Compressor running – each bit represents running signal of one compressor (MSB = ARCHON ready, MSB-1 = compressor A), 1 = compressor running, 0 = compressor idle
2	2	UINT	Working pressure in technical units, 1 TU represents 100 physical units.
3	2	UINT	FAD in technical units, 1 TU represents 100 physical units.
4	2	UINT	Power in measured units.
16 - 63	4	ULONG	MTH of each compressor (16 = A, 18 = B, etc.)

7 Technical specification

7.1 Basic operation details

7.1.1 Control module

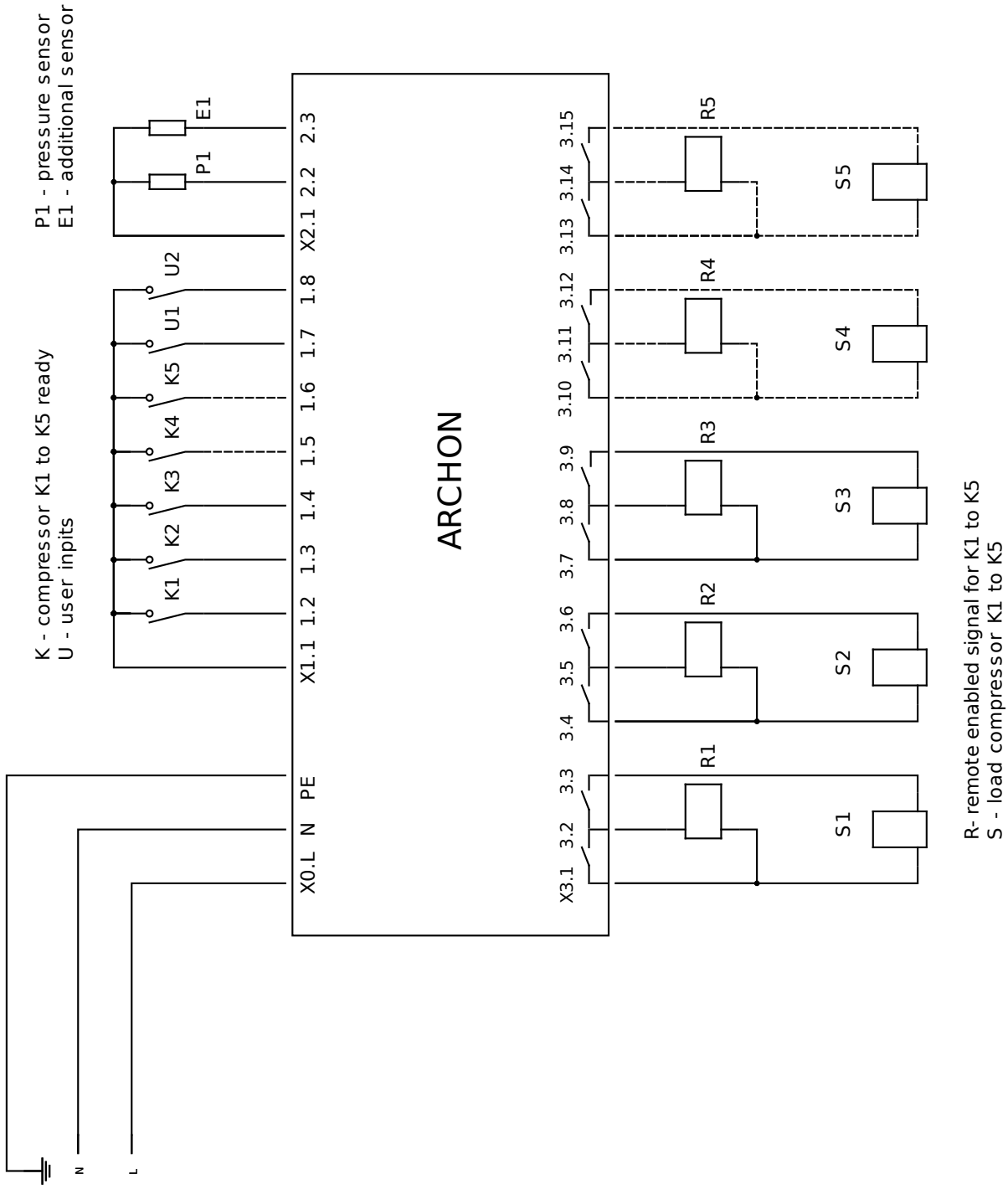
Version	v230	v24
Supply votlage	88 ~ 264 VAC	22.0 ~ 28.8 VDC
Frequency	47 ~ 63 Hz	–
Energy consumption (w/o LCD)	16 W	12 W
Operation temperature	-20 ~ 60 °C	

7.1.2 LCD

Version	Basic	Advanced
Supply votlage	19.2 ~ 28.8 VDC	
Current – nominál / maximal	100 mA / 150 mA	125 / 310 mA
Operation temperature	0 ~ 50 °C	

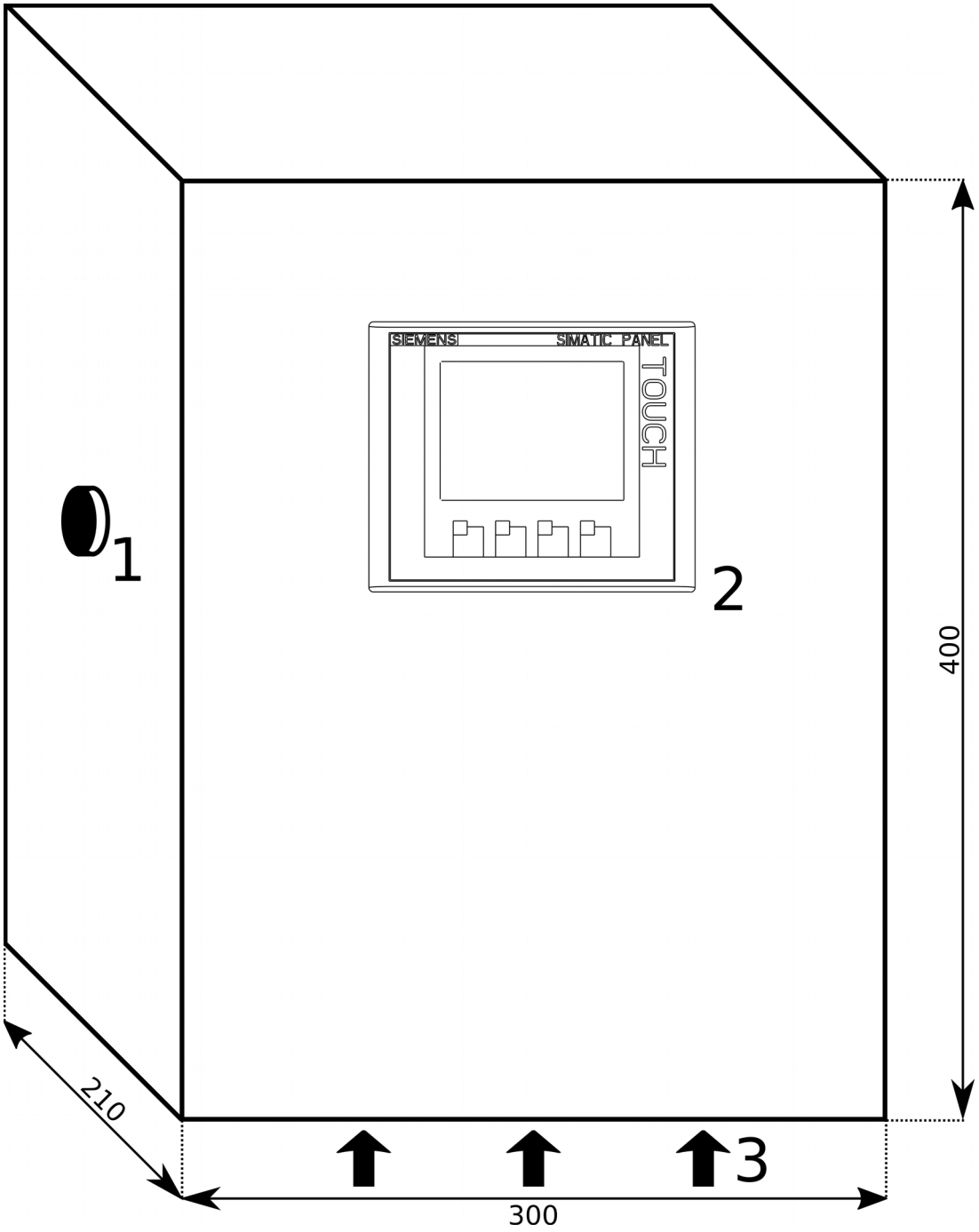
Consult controller and HMI handbook supplied together with the device for more details.

7.2 ARCHON 3/5 recommended wiring diagram



Pozn. Ports X3.10 to X3.15 and X1.5, X1.6, resp. are available only in ARCHON5.

7.3 ARCHON dimensions



Legeng:

1 – main power switch

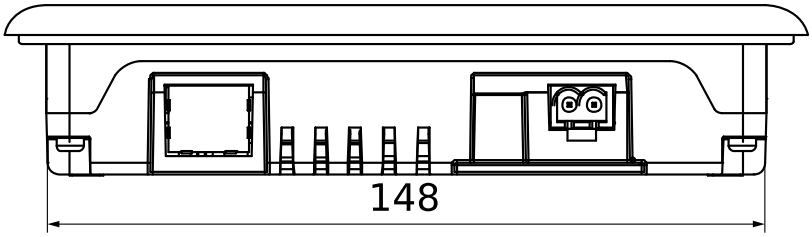
2 – control LCD

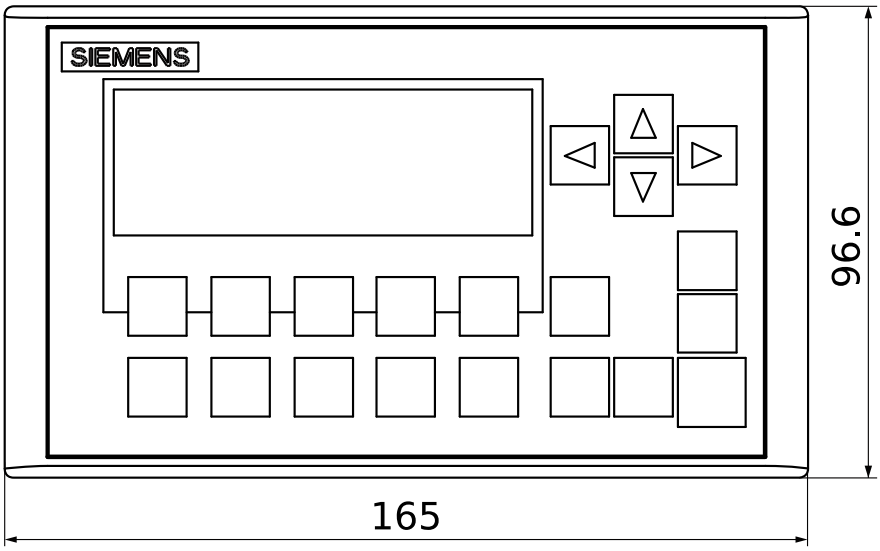
3 – input clamps

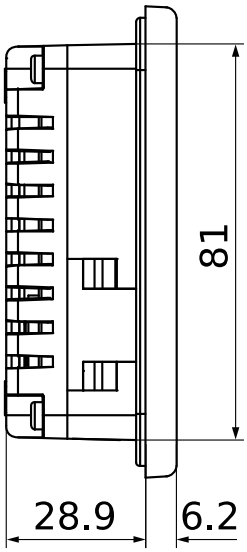
All dimensions in mm.

7.4 ARCHON Basic dimension

All dimension in mm.

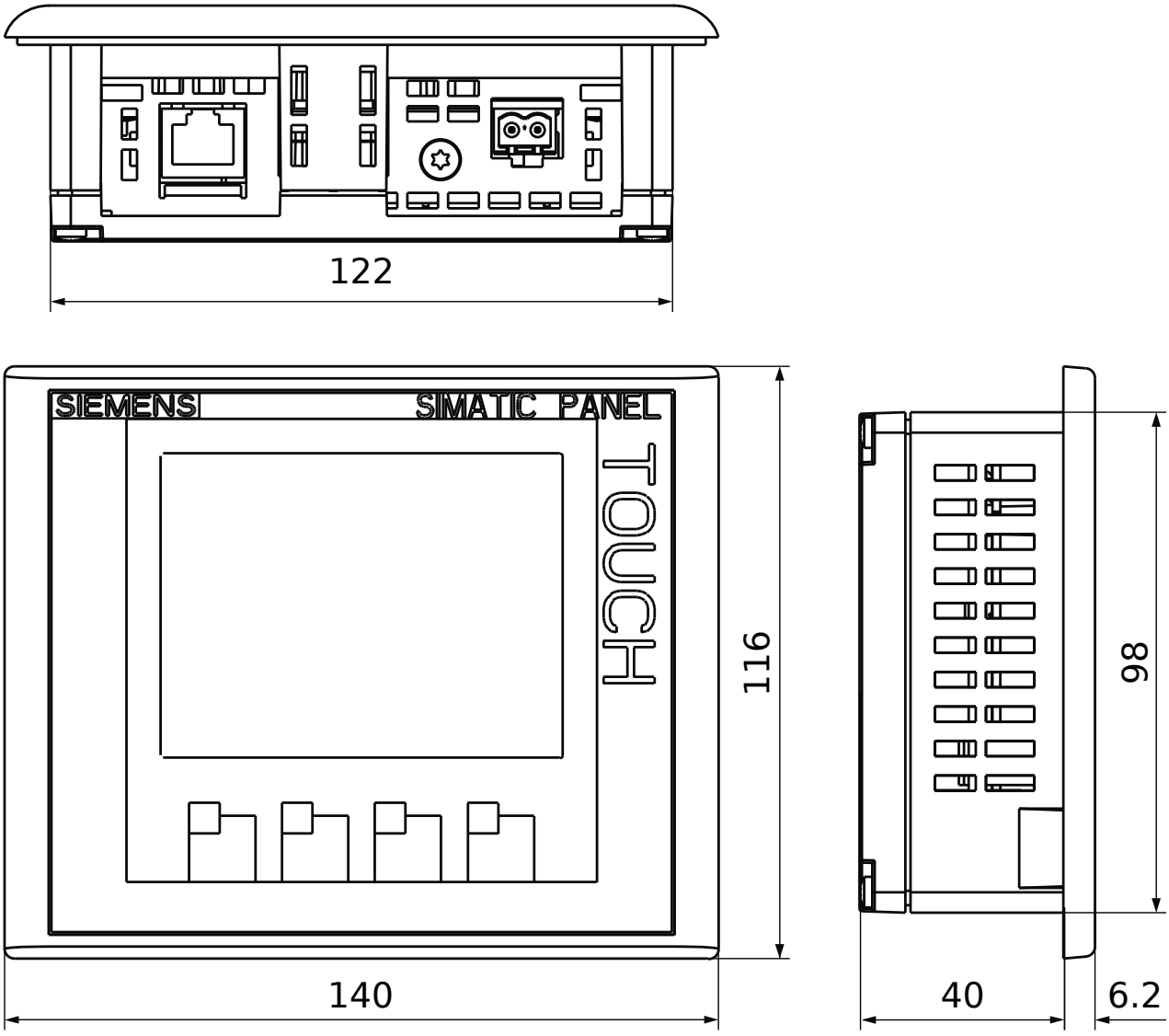






7.5 ARCHON Advanced dimensions

All dimension in mm.



8 Firmware update

Firmware can be updated by SD card provided by the manufacturer. Update can result to change of configuration or some user functions. Contact the manufacturer for more details.

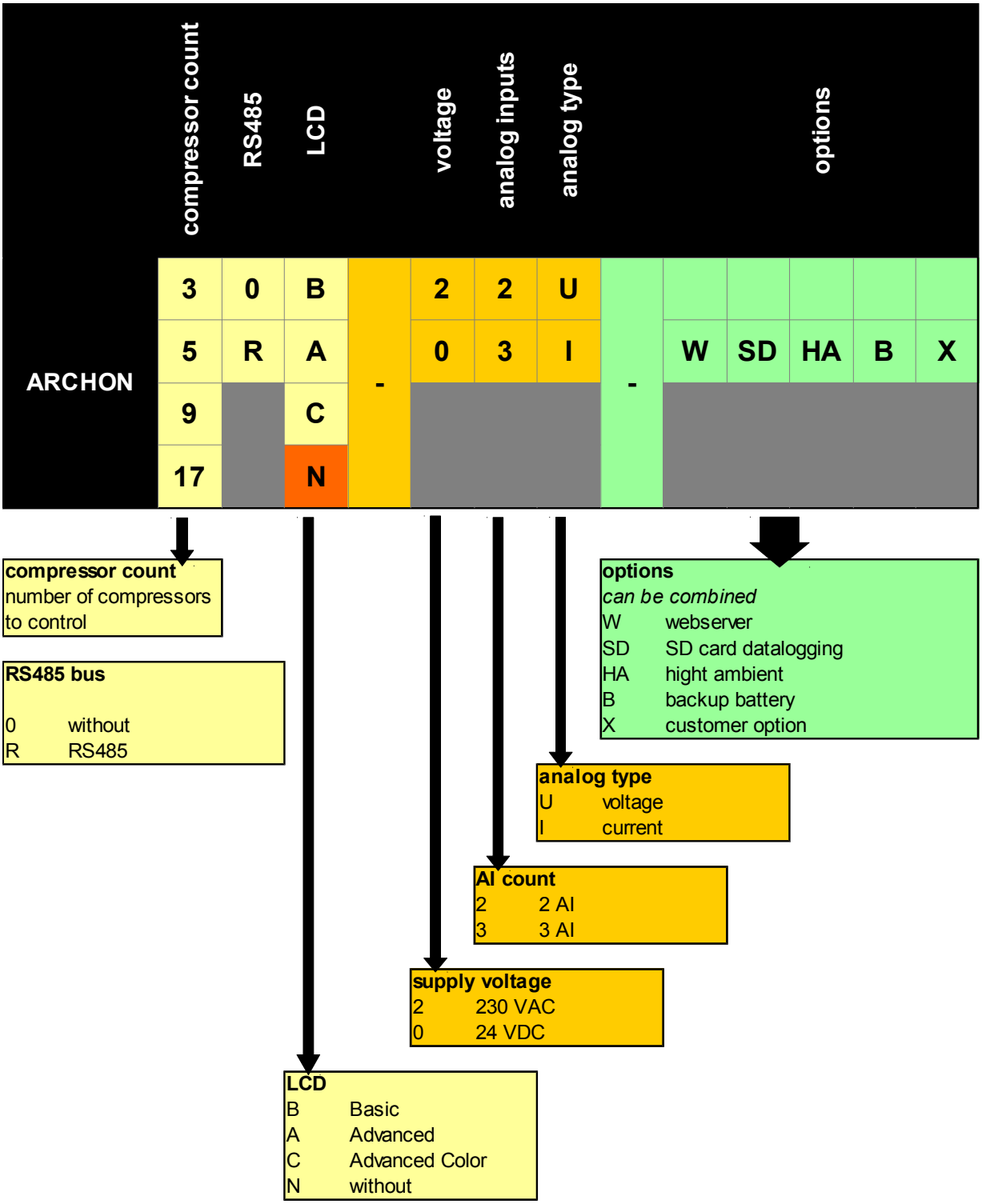
9 Technical requirements

You can use following table to specify a technical inquiry of the ARCHON control system. Please, check all required variants and options and/or attach notes to the „customer option“ column.

Parameters	option 1	option 2	customer option
Compressor count	3	5	
Frequency inverter driven compressors			
Supply voltage	230 VAC	24 VDC	
Analogov input AI0 (pressure)	0 ~ 10 V	4 ~ 20 mA	
Analogov input AI1 (FAD / power)	0 ~ 10 V	4 ~ 20 mA	
LCD	yes	no	
• version	basic	advanced	
• LCD position	internal	external	
• color (Advanced only)	yes	no	
Power measurement	yes	no	
• Current and voltage of the entire compressor station			
Webserver	yes	no	
SD card logging	yes	no	
RS485 for remote monitoring	yes	no	
High ambient version (-40 °C)	yes	no	
Backup battery for long term shutdowns	yes	no	
Additional info			

If precise specification is known, you can use table in paragraph 9.1.1 for order code generation. Please, keep in mind that the controller without LCD has only limited capabilities and can not be set without additional accessories.

9.1.1 Ordering code



I.e. *ARCHON 50A-22I-W* is ordering number for ARCHON 5 – control unit for 5 compressors on digital line, with Advanced LCD, supplied with 230 VAC, 2 analog inputs and a web server.