AE-BU Series Controller

User Handbook

v1.0.4 (2024-09-13)

For BUSCH Vyroba s.r.o.
manufactured by:

ARDAT Systems s.r.o.
Přední cesta 905/9
32600 Plzeň
Czech Republic

http://ardat.cz

Content

1 Introduction

Thank you for buying AE-BU series controller – the powerful integrated controller designed especially for effective and reliable compressor/blower/vacuum pump control.

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.

🛠 Example

Practical examples contain hints and best practices for different situations.

1.1 Changelog

Version 1.0.4: vacuum/pressure and reference/speed settings added

Version 1.0.3: auto-restart and Annex I added.

Version 1.0.2: added specific error codes, improved wording.

Version 1.0.1: control description extended.

Version 1.0.0: initial release.

2 Storage and installation

2.1 Controller storage

AE-BU series controller 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 can lead to real time clock battery discharge. Please follow the Annex I: How to replace the battery and restore the settings, if needed.

2.2 Controller installation

AE-BU series controller is not designed to be installed by end customers. Installation must be performed by a qualified electrician trained by the manufacturer. All details as well as schematics are available in the Technical report provided here: https://ardat.cz/dokumentace-rozvadecu-ae-bu/

⚠ Warning

The controller must be installed by a qualified electrician.

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

⚠ Warning

The controller is designed for various voltages 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 electronics. Pay attention to correct earthing when connecting the machine.

⚠ Warning

When changing any internal connections (to the machines, to sensors or to optional devices), it is necessary to switch the controller off and disconnect from the power source. The power supply can be reconnect after the switchboard door are closed.

DANGER

RISK OF ELECTRIC SHOCK!

Certain machine electrical components still remain live when the main switch is turned off.

These are:

- Incoming electrical supply terminal block components, up to the main switch.
- Heating function components.
- Externally supplied interface signals.

The corresponding circuits use orange-coloured wires. For detailed information refer to the electrical schematics.

Before working on these components, you must make sure the associated voltage supplies are switched off (for example lockout/tagout (LOTO) procedure of the corresponding supply by the customer.

3 Safety instructions

The following safety instructions are to be observed:

The installation, commissioning, troubleshooting as well as repair of the controller may only be carried out by qualified personnel that is familiar with the corresponding operating instructions. Device connection and installation has to follow all the valid standards, state and local regulations. Proper grounding and conductor dimensions as well as proper short-circuit proofing have to be ensured. These measures serve to ensure the safety of the plant and of the operating personnel. Before carrying out safety checks, maintenance work and repair measures ensure that all the power supplies are switched off, are secured against being switched on unintentionally and are marked correspondingly. Only test devices that are in technically perfect condition and are suitable for the respective measurement may be used to carry out measurements!

The instructions specified in the respective operating instructions are to be followed strictly! It is mandatory that hazard, warning and safety instructions are followed!

All doors and covers are to be kept closed during the controller operation. If cooling devices are installed in the controller, ensure that these systems operate trouble-free. These include the regular cleaning of the filters, in as far as they exist.

⚠ Warning

During controller operation certain items are under dangerous voltage! Non-observance of safety instructions can result in death, serious injuries or material damage. Only specialist personnel may carry out transport, installation and commissioning work. The applicable valid standards as well as the national and / or company-specific accident prevention regulations are to observed.

4 Description

AE-BU series is an indoor, metal sheet, totally enclosed cabinet designed for control and powering of the blower/compressor/vacuum pump unit and complies with EN 60204-1 and EN 61439-1. The switchboard consists of electric components, which ensure starting, running and safe operation of the machine. See the fig 4.1 for the overview of the components. The switchboard is secured against short circuit by main power switch/circuit breaker 3F1 (1). Start and blower speed control is controlled by frequency converter driven by the AECon touch panel 3A8 (2). In case of emergency, the machine can be stopped immediately by pressing the Emergency stop button (3).

Fig. 4.1: Control cabinet

5 Control

The control system initializes automatically after switching on by the main power switch/circuit breaker (see chapter 4). Press START button on the AECon touch panel. The machine will start. Please note, that the Local/Remote switch is not operational when the machine is running. It is possible to read current value of the blower charge/discharge pressure and the drive parameters on the AECon touch panel.

Home screen containing basic parameters of the machine is launched (see Fig. 5.1).

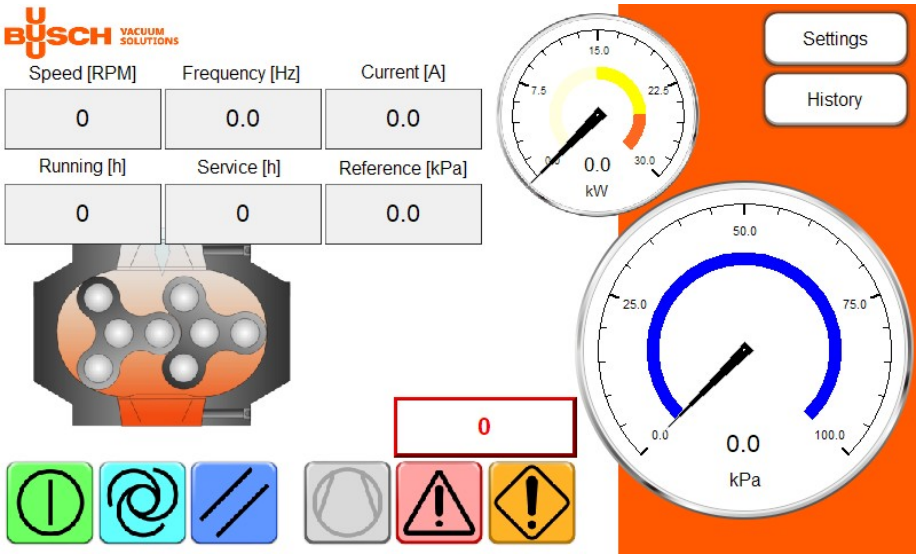

Fig. 5.1: Home screen

The Home screen shows all the measured media variables like pressure and drive status represented by speed, frequency, current and consumed power.

The upper right part contains the buttons to switch to next screens: Settings (password protected) and History.

The bottom left part of the screen contains four control buttons:

- – START button: Start the device. This button is only active in local control mode.
- – STOP button: Stop the device. This button is only active in local control mode.
- / – Remote / local (automatic) mode indicator. The mode can be switched by pressing this button. This button is only active when the machine is stopped.
- Reset – resets the drive alarms. This button is active only when alarm occurs.

The status of the controller is signalized by following icons:

/ Grey = drive is stopped, green = drive is on.

Warning – drive is still operational but some values are reaching the warning limits.

Drive error – drive is not operational, check the drive error code displayed next to this icon.

Check the error code (see 7.1 Main error events) and the alarm history (see chapter 5.3 History). Once the problem is eliminated, you can remove the error message by pressing the Reset button.

⚠ Warning

Do not reset the error or try to start the machine after an error until you eliminated the root cause, which stopped the machine. Otherwise you may damage the machine/controller permanently.

✎ Note

The runtime parameters like Remote / local control will be saved in the controller permanent memory and reloaded after a power shutdown. However, it takes several seconds to save the memory, so if you disconnect the power immediately after the change, the change might not be saved to the permanent memory.

5.1 Starting the machine

Check the controller status. If no error is shown, you may press the Start button to start the machine. Once the machine is started, it will be ready to start the drive as soon as the pressure/vacuum drops below Pstart.

The controller will regulate the motor speed to keep the pressure at Pset level. If the pressure/vacuum rises above Pstop, the drive will stop and the machine will go to the ready state.

The machine can be stopped by pressing the Stop button.

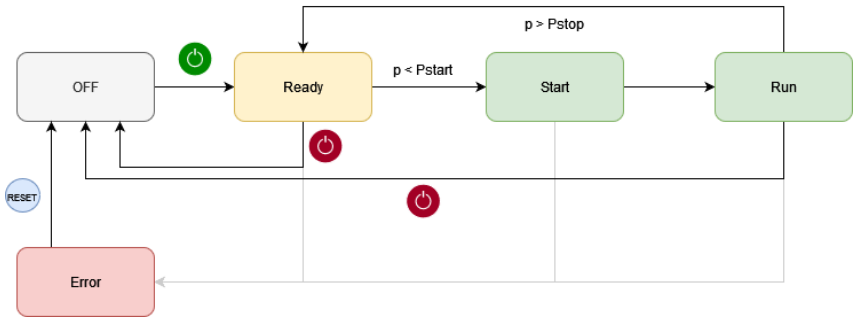

Fig. 5.2: Control state diagram

5.2 Remote operation

The controller can be set to remote operation mode by pressing the Remote button. In this case, the Start/ Stop button is not operational and the machine is started remotely by Remote START/STOP digital input (NO contact via terminal connectors –X5:3, -X5:6). During the remote operation, the Pset settings is ignored and the reference pressure is taken from the Remote control 0-10 V.

The current condition of blower is reported via zero-potential contacts -X5:1, -X5:2 - connected (NO): operation, –X5:7, -X5:8 connected (NC): blower not ready (alarm).

⚠ Important

The Pstart and Pstop settings are still valid (the machine will stop when pressure exceeds Pstop and will not start until the pressure will drop below Pstart), so the pressure reference should always be within this range.

5.3 History

Open the History screen by pressing the History button.

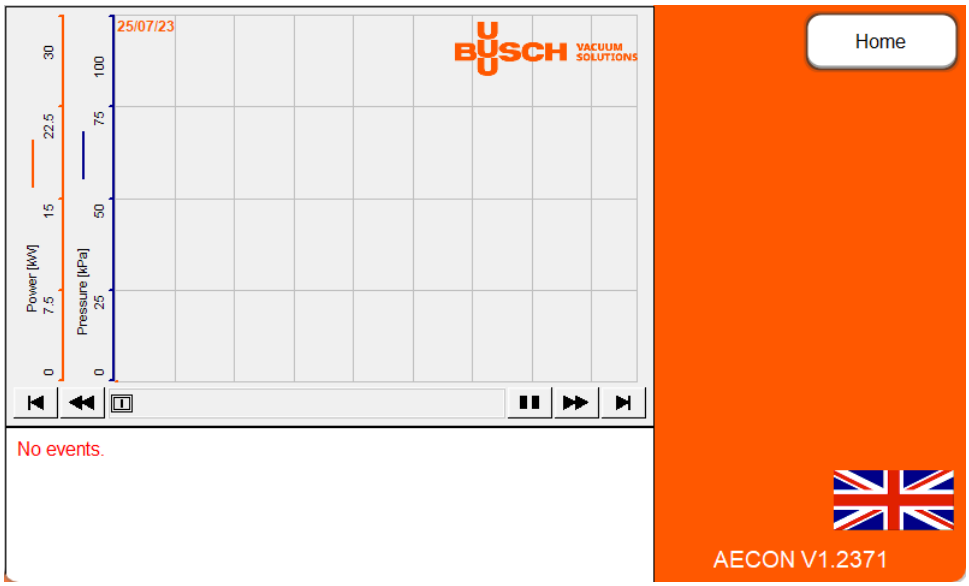

Fig. 5.3: History screen

This screen shows the Pressure and Power chart updated each 5 seconds.

The event log is displayed below the chart. Each event has following records: event number, date, time, event/error description, number of occurrences and event acknowledged time.

You can change the controller language by pressing the flag in the right part of the screen or return to the Home screen by pressing the Home button.

6 Controller settings

Press the Settings button. If you are not logged in, you will first be asked for the password. There are two security levels:

security level	password
user	121
admin	9987

Once the input is confirmed, you can press Settings again and the Settings screen will be displayed.

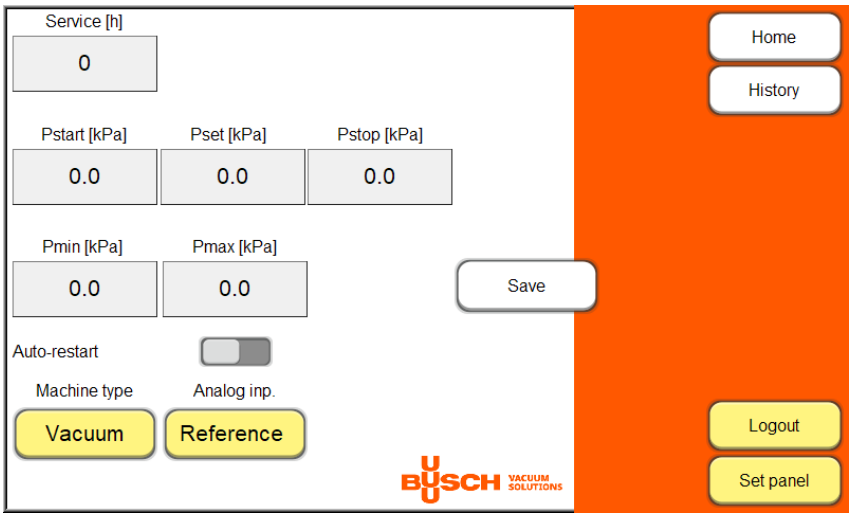

Fig. 6.1: Settings screen

The settings screen contains following parameters:

parameter	units	user level	description
Service	mth	user	next maintenance MTH
Pstart	kPa	user	starting (minimal) pressure
Pset	kPa	user	set pressure (reference)
Pstop	kPa	user	stop (maximal) pressure
Pmin	kPa	admin	minimal pressure sensor value
Pmax	kPa	admin	maximal pressure sensor value
Auto-restart		admin	automatic restart after power failure
Vacuum/Pressure		admin	control preset for vacuum pump or blower/compressor

parameter	units	user level	description
Reference/Speed		admin	analog input used as reference signal or speed control

Each value can be edited by touching the edit box. Once the value is edited, it needs to be saved to the drive by pressing the Save button.

The auto-restart button sets the controller behavior after the power failure. If the auto-restart is ON, the machine will be restarted, if it was started during the power failure.

You can quit the settings screen by pressing the Logout button. The user will also be logged out after several minutes automatically.

The Set panel button open the HMI settings, where you can set the date, time and other advanced HMI parameters. Changing the network settings is not recommended. Please, contact the support for detailed instructions if needed.

7 Errors

7.1 Main error events

Error/warning codes are displayed on the main screen above the error/warning sign:

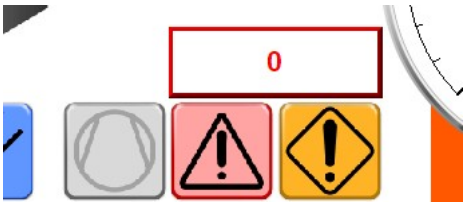

Fig. 7.1: Error/warning code

Error code	Description
2	Pressure sensor failure
3	Mains phase loss
6	Inverter DC overvoltage
7	Inverter DC undervoltage
8	Inverter overloaded
10	Motor thermistor overtemperature
11	Torque limit
12	Overcurrent
13	Ground fault
14	Earth (ground) fault
16	Short circuit
17	Comm. timeout
31	Motor phase missing
68	Emergency button
188	Emergency button
235	Temperature switch shutdown

7.2 Complete list of drive errors/warnings

No.	Description	Warning	Alarm	Trip lock	Cause
2	Live zero error	X	X	–	The signal on terminal 53 or 54 is less than 50% of the value set in *parameter 6-10 Terminal 53 Low Voltage*, *parameter 6-20 Terminal 54 Low Voltage*, and *parameter 6-22 Terminal 54 Low Current*.
3	No motor	X	–	–	No motor has been connected to the output of the frequency converter.
4	Mains phase loss[1)]	X	X	X	Missing phase on the supply side, or the voltage imbalance is too high. Check the supply voltage.
7	DC overvoltage[1)]	X	X	–	DC-link voltage exceeds limit.
8	DC undervoltage[1)]	X	X	–	DC-link voltage drops below the voltage warning low limit.
9	Inverter overloaded	X	X	–	More than 100% load for too long.
10	Motor ETR overtemperature	X	X	–	Motor is too hot due to more than 100% load for too long.
11	Motor thermistor overtem-perature	X	X	–	Thermistor or thermistor connection is disconnected, or the motor is too hot.
12	Torque limit	X	X	–	Torque exceeds the value set in either *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.
13	Overcurrent	X	X	X	Inverter peak current limit is exceeded. If this alarm occurs on power-up, check whether power cables are mistakenly connected to the motor terminals.
14	Ground fault	–	X	X	Discharge from output phases to ground.
16	Short circuit	–	X	X	Short circuit in motor or on motor terminals.
17	Control word timeout	X	X	–	No communication to frequency converter.
25	Brake resistor short-circuited	–	X	X	Brake resistor is short-circuited, thus the brake function is disconnected.
26	Brake overload	X	X	–	The power transmitted to the brake resistor over the last 120 s exceeds the limit. Possible corrections: Decrease brake energy via lower speed or longer ramp time.
27	Brake IGBT/brake chopper short-circuited	–	X	X	Brake transistor is short-circuited, thus the brake function is disconnected.
28	Brake check	–	X	–	Brake resistor is not connected/working.
30	U phase loss	–	X	X	Motor phase U is missing. Check the phase.
31	V phase loss	–	X	X	Motor phase V is missing. Check the phase.
32	W phase loss	–	X	X	Motor phase W is missing. Check the phase.
34	Fieldbus fault	X	X	–	PROFIBUS communication issues have occurred.
35	Option fault	–	X	–	Fieldbus detects internal faults.
36	Mains failure	X	X	–	This warning/alarm is only active if the supply voltage to the frequency converter is less than the value set in *parameter 14-11 Mains Fault Voltage Level*, and *parameter 14-10 Mains Failure* is NOT set to *[0] No Function*.
38	Internal fault	–	X	X	Contact the local Danfoss supplier.
40	Overload T27	X	–	–	Check the load connected to terminal 27 or remove short-circuit connection.
46	Gate drive voltage fault	–	X	X	–
47	24 V supply low	X	X	X	24 V DC may be overloaded.

No.	Description	Warning	Alarm	Trip lock	Cause
49	Speed limit	–	X	–	The motor speed is below the specified limit in *parameter 1-87 Trip Speed Low [Hz]*.
50	AMA calibration failed	–	X	–	A calibration error has occurred.
51	AMA check U_{nom} and I_{nom}	–	X	–	Wrong setting for motor voltage and/or motor current.
52	AMA low I_{nom}	–	X	–	Motor current is too low. Check the settings.
53	AMA big motor	–	X	–	The power size of the motor is too large for the AMA to operate.
54	AMA small motor	–	X	–	The power size of the motor is too small for the AMA to operate.
55	AMA parameter range	–	X	–	The parameter values of the motor are outside of the acceptable range. AMA does not run.
56	AMA interrupt	–	X	–	The AMA is interrupted.
57	AMA timeout	–	X	–	–
58	AMA internal	–	X	–	Contact Danfoss.
59	Current limit	X	X	–	Frequency converter overload.
60	External interlock	–	X	–	External interlock has been activated.
61	Encoder loss	X	X	–	–
63	Mechanical brake low	–	X	–	The actual motor current has not exceeded the release brake current within the start delay time window.
65	Control card temp	X	X	X	The cutout temperature of the control card has exceeded the upper limit.
67	Option change	–	X	–	A new option is detected or a mounted option is removed.
68	Safe Torque Off[2)]	X	X	–	STO is activated. If STO is in manual restart mode (default), to resume normal operation, apply 24 V DC to terminals 37 and 38, and initiate a reset signal (via fieldbus, digital I/O, or [Reset]/[Off Reset] key). If STO is in automatic restart mode, applying 24 V DC to terminals 37 and 38 automatically resumes the frequency converter to normal operation.
69	Power card temp	X	X	X	The cutout temperature of the power card has exceeded the upper limit.
80	Drive initialized to default value	–	X	–	All parameter settings are initialized to default settings.
87	Auto DC braking	X	–	–	Occurs in IT mains when the frequency converter coasts, and the DC voltage is higher than 830 V for 400 V units and 425 V for 200 V units. The motor consumes energy on the DC link. This function can be enabled/disabled in *parameter 0-07 Auto DC Braking*.
88	Option detection	–	X	X	The option is removed successfully.
95	Broken belt	X	X	–	–
99	Locked rotor	–	X	–	Rotor is blocked.
120	Position control fault	–	X	–	–
126	Motor rotating	–	X	–	PM motor is rotating when AMA is performed.
127	Back EMF too high	X	–	–	The back EMF of PM motor is too high before starting.
188	STO internal fault[2)]	–	X	–	24 V DC supply is connected to only 1 of the 2 STO terminals (37 and 38), or a failure in STO channels is detected. Ensure that both terminals are powered by a 24 V DC supply, and that the discrepancy between the signals at the 2 terminals is less than 12 ms. If the fault still occurs, contact the local Danfoss supplier.

Please, refer to the drive operating manual for more details:

- FC-280: https://files.danfoss.com/download/Drives/MG07A502.pdf
- FC-302: https://files.danfoss.com/download/Drives/MG38A202.pdf

8 Annex I: How to replace the battery

Q.

How to replace a coin lithium battery?

Weintek HMI takes one CR2032 / CR1225 / CR1220 coin lithium battery to keep the RTC running.

Battery specification: CR2032 / CR1225 / CR1220 3V lithium battery.

This FAQ explains how to change HMI's battery.

A.

Step 1. Turn off the HMI and open its rear cover or battery cover.

Step 2. Use a screwdriver to remove the battery from the battery holder.

Step 3. Insert a new battery as shown below.

Step 4. Put on the rear cover or battery cover and then turn on HMI to reset the RTC time.

Note: Replacing battery shall be performed by qualified personnel only and be careful in handling lithium batteries.