

Danfoss



On Site Guide AK2-SC 255

REFRIGERATION AND
AIR CONDITIONING

How to Use This Guide

Read this Guide completely as you install and start up your new AK2-SC 255 controller. The guide will give you thorough installation instructions as well as guidance on beginning configuration of the control software. If you read through the section on refrigeration, you will gain an understanding of a way to interact with the system. You will also ensure that the refrigeration will start up with basic settings appropriate to the equipment on site.

What's Needed for Installation

What you will need to finish the installation:

1. A screwdriver
2. A drill and fasteners appropriate to mounting the controller.
3. A dedicated 120V or 208/230V circuit (the unit is fused internally at 2.5 A)
4. OEM installations require a dedicated disconnect

Wire and Cable Requirements

Power: 14AWG minimum

Communications:

Ethernet	24AWG, CAT5, Belden or equivalent
Host	18-22AWG, Belden or equivalent
I/O Network	18-22AWG, Belden or equivalent

Use RJ-45 connectors without strain relief inside the AK2-SC 255.

A Note about Code Compliance

Danfoss believes that no instruction in this guide violates or is in contravention of any national or local electrical code, but the installer is responsible for compliance with any code applicable to the installation site. Use the installation drawing as reference.

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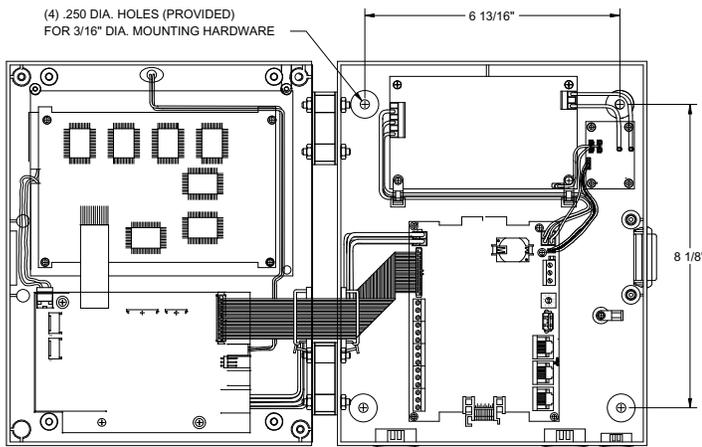


Fig. 1 Mounting screw locations

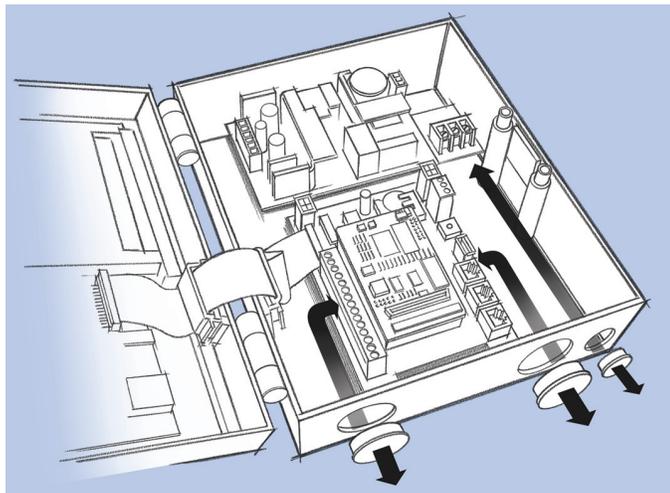


Fig. 2 Conduit entrances

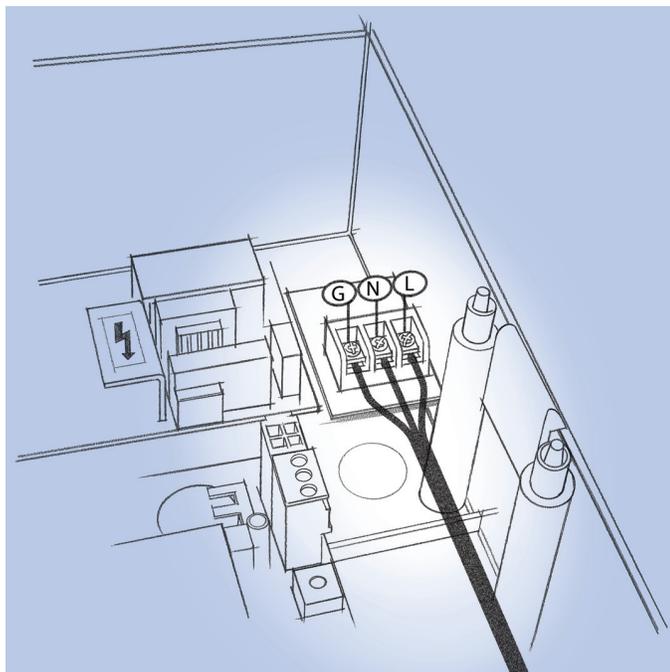


Fig. 3 Power connection

Mounting and Wiring

Mounting

The illustrations shown in this On Site Guide show components as they are laid out in the box-mount version of the controller. The panel-mount version, installed by rack OEMs, has the same components, but mounted in a "stack." Nevertheless, the connections are made in the same manner, and the orientation of the main board is the same in both controller versions.

The mounting location must be flat, and the controller should be mounted at eye level. The AK2-SC 255 controller is 9"W x 10"H. Insure that there is an area at least 20" x 20" for the AK2-SC 255 (with the door open) and a modem, and leave room for conduit connections beneath the controller. Often a sheet of plywood is secured to a wall, and the controller mounted on the plywood. Mount the controller using appropriate screws through the holes indicated at left, fastening the back of the controller enclosure securely to the flat surface you have chosen.

Making connections to the controller

Conduit entrances, shown by broad black arrows in Figure 2, are (left to right) for I/O network, communications, and power, which should be kept segregated.

Power connection

Connect power as shown in Figure 3, but do not energize the AK2-SC 255 until the remaining connections, described on the following pages, have been made. If connecting 120Vac, connect ground, neutral, and line conductors exactly as shown at left. If connecting 230 Vac, connect ground as shown, and connect L1 and L2 to the other terminals. There are no jumpers to change. Do not apply power to the unit until the unit has been addressed and all the other connections described below have been made.

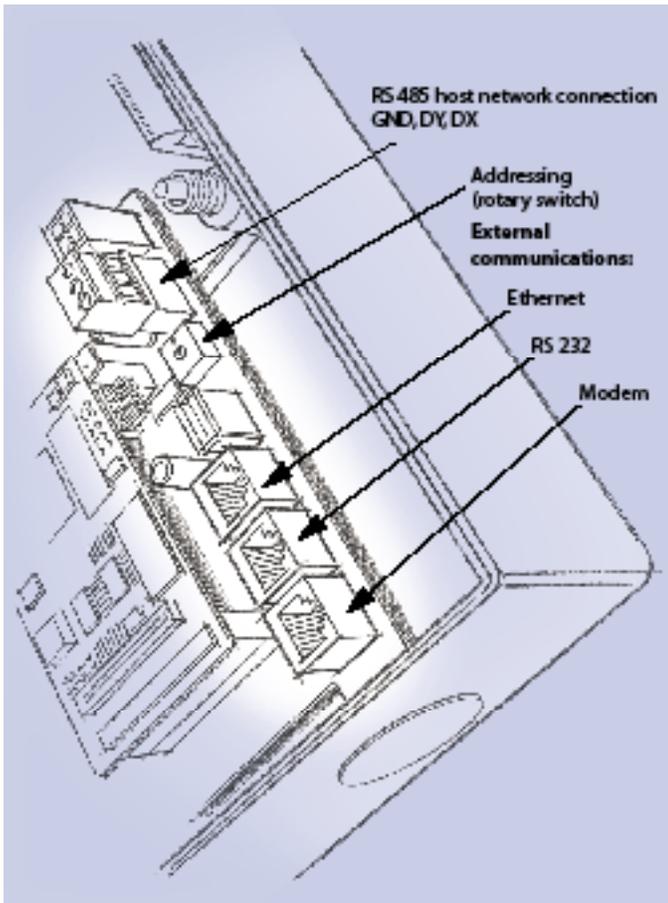


Fig. 4 The right side of the main circuit board

Wiring the host network

Up to 10 AK2-SC 255 controllers can be connected in a host network. There are two means of establishing communications between a number of AK2-SC 255 controllers: RS-485 and Ethernet. The system owner will select one of these methods. If the AK2-SC 255 is to be connected to an existing AKC 55 host network, all host network cabling must be RS-485.

RS-485 host networks:

Using 2-conductor stranded shielded cable, AWG 18, connect the shield at one end of the AK2-SC 255 host network. When the controller is shipped from the factory, a termination resistor is in place across each set of the RS-485 terminals. Remove the termination resistors except at first and last units on the host network.

Addressing the AK2-SC 255 controller

Each AK2-SC 255 in the host network must have a unique address from 0 to 9. The master controller for the network ("first unit") has address 0. Set an address for the new unit that is not being used by any other unit on the network. The address is set by using a small screwdriver to adjust the rotary switch (shown in Figure 4) on the main electronics board.

Ethernet host networks:

A local Ethernet connection can be established between host network controllers. If desired, the host network can also be connected to the store's Wide Area Network (WAN). Connect each AK2-SC 255 to a router using a standard RJ-45 (8-wire) Ethernet cable (without strain relief, so that the bending radius is minimal) Then, if WAN connection is desired, connect the router to the store's WAN.

Connecting external communications

External communications are those that take place between the AK2-SC 255 and locations off site.

External communications by Ethernet

Connect using a standard RJ-45 Ethernet cable (without strain relief) from the Ethernet jack inside the AK2-SC 255.

Local connection

Local connection to a PC can be established using the RS232 connector of the AK2-SC 255. A standard RJ-45 Ethernet cable and a special PC adaptor are required for local connection. The same RS-232 connector in the AK2-SC 255 can be used to connect a local alarm printer to the AK2-SC 255.

External connection by dial-up modem

Connect to the modem jack of the AK2-SC 255 and to the modem using a standard RJ-45 Ethernet cable and a modem adaptor supplied by Danfoss with the modem. The modem adapter is shown in Figure 5.

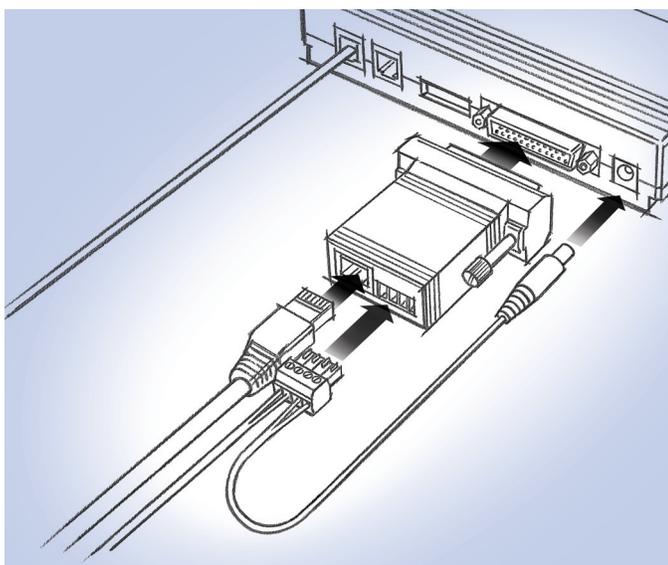
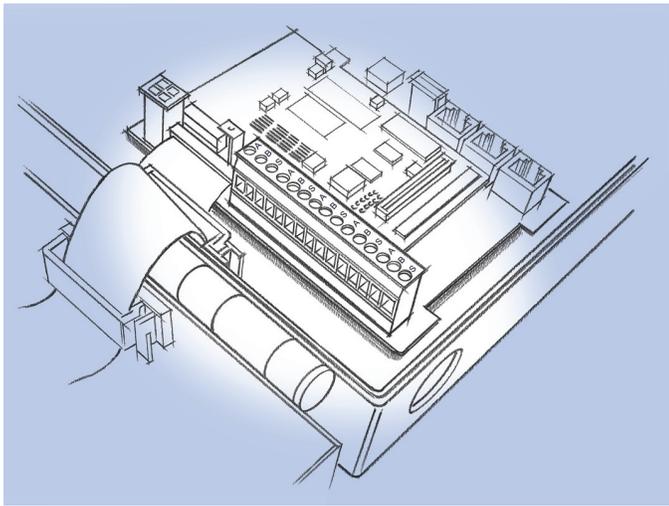


Fig. 5 Connecting an external modem and adapter

Note: Power is routed through the modem connector to allow for modem resets.



Connecting the I/O network

The I/O (Input-Output) network uses Echelon® LonTalk® communications. Up to five I/O network cables can be connected to each AK2-SC 255, one to each of the sets of terminals labeled "A," "B," "Shield" on the left side of the controller's main electronics board. When connecting "A" and "B" conductors, there is no polarity to observe. For more information about connecting I/O cables, and restrictions on their length and layout, consult the Reference Manual. Attach a terminator to each set of unused I/O terminals.

When all connections have been made, and the unit is properly addressed, apply power to the unit. Within 20 seconds the main menu should appear on the display screen. If necessary, set the display contrast by adjusting the control behind and below the display with a small screwdriver as shown.

Fig. 6 Location of the I/O terminals

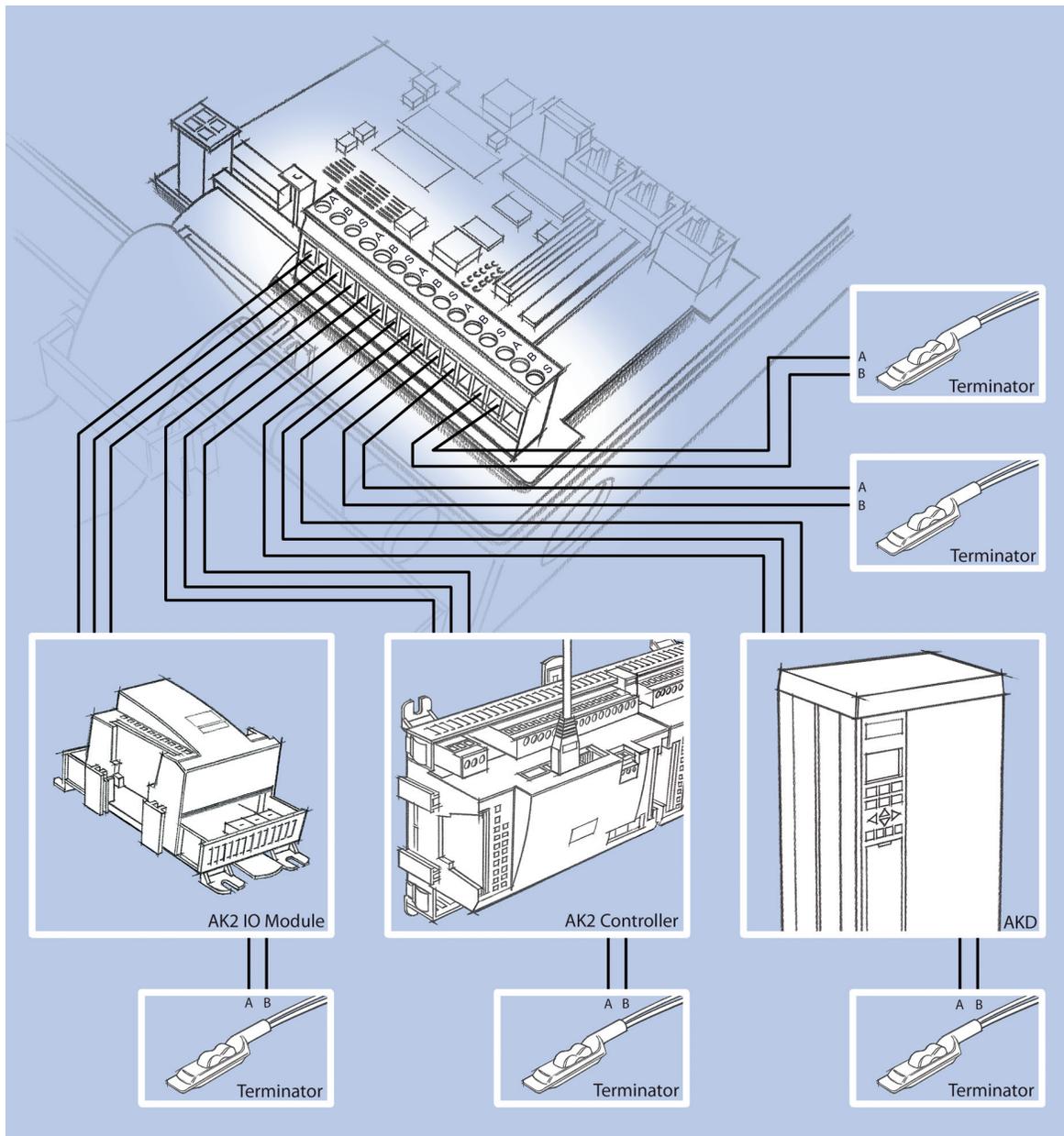


Fig. 7 I/O network connections and terminators

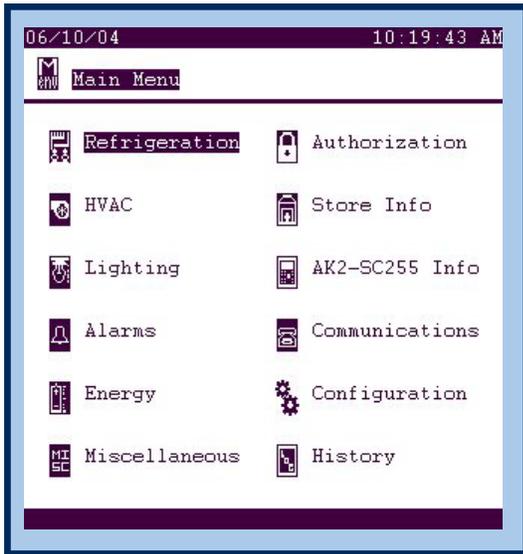


Fig. 8 The main menu

Navigation, Authorization, and the Keypad

The Main Menu

Look at the display. It should be the main menu shown in Figure 8, but if you don't see "Main Menu" in the screen title field below the date, press the MENU key.

The top line, in reverse video (white or color on a black background) contains the date and time. Just below that is the screen title field, then a line. The title of the screen at left in Figure 8 is "Main Menu." Below the line is the body of the screen, in this case containing the menu items.

Notice that the first item in the screen body is in reverse video, light characters on a dark background. That is because the cursor is on the menu item "Refrigeration." Anytime the cursor is moved to a field, the field will be in reverse while the cursor is there.

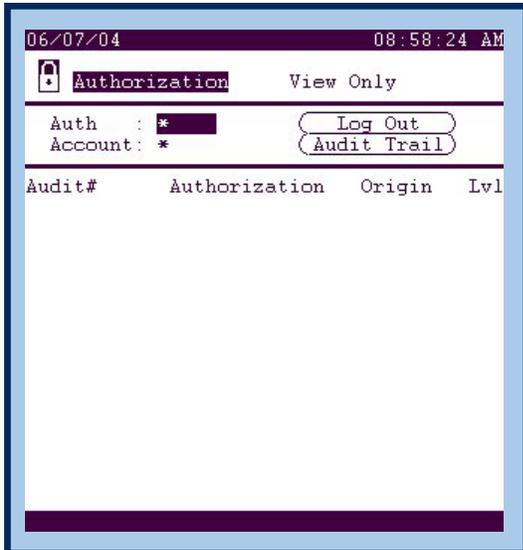


Fig. 9 Authorization screen

Authorization

Move the cursor, using the arrow keys, to the menu item "Authorization" and press the ENTER KEY. Your screen should look like the one shown in Figure 9. Notice the words "View Only" on the right side of the screen heading.

On the Authorization screen, the cursor is on a field called "Auth." Below that is a field called "Account." Your first operation, each time you use the controller, will be to enter your authorization code and account number. These will be given to you by the system owner. The default authorization code from the Danfoss factory is 12345, and the default account code is 50. If the unit was delivered from a rack manufacturer, it's likely that the default code and account number will work. Without moving the cursor, key in your authorization code (only asterisks will appear, so no one else can see your code). Press ENTER and the cursor will move to the field below, "Account." Key in your account code and press ENTER. The screen will change, and look similar to the one shown in Figure 10. Compare the screens above and notice the changes. They are really self-explanatory.

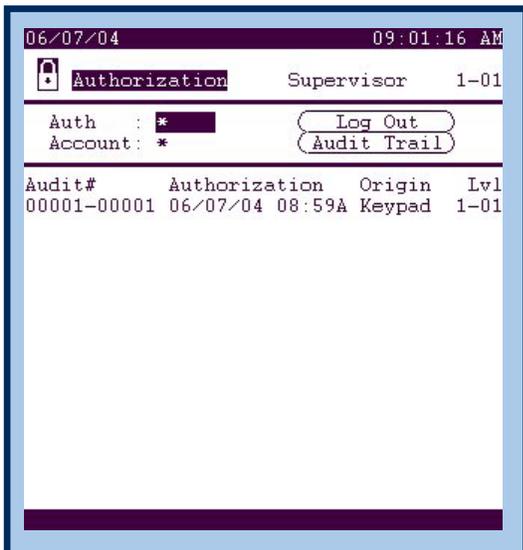


Fig. 10 After authorization

After entering your code and account number, the *authorization level* in the screen the heading will change from "View Only" to a higher level (one that allows changes to configurations).



Fig. 11 The AK2-SC 255 keypad controller

Navigation

Each key on the keypad (seen in Figure 11) has a unique function. Those that may be new to you, and those that have special functions on your new controller, are:

ESC (red): will take you back one level. You can return all the way to the main menu by repeatedly pressing ESC. But a quicker way to reach the main menu is by pressing MENU.

MENU: returns you to the main menu.

NEXT: moves to the next screen of a group. For example, if you are configuring evaporator 16, the next key will take you to evaporator 17's configuration screen.

PREV: is the opposite of NEXT

PG DN: for screens with more than one page, takes you to the next page. When a next page is available, you will see "PG DN" in the lower right corner of the screen body.

PG UP: for screens with more than one page, after you have moved down, takes you back up.

F1, F2, F3, F4: These keys, just below the screen, are "soft keys." Pressing one of these keys will cause an action indicated by the label, if any, above it on the screen.

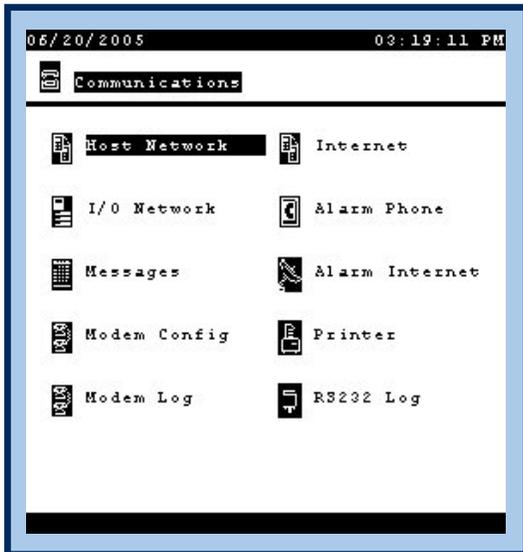


Fig. 12 Communications menu

Modem Configuration

Proper configuration of communications is essential for management of your ADAP-KOOL network. Begin from the main menu.

Move the cursor to "Communications," and press ENTER to produce the communications menu (Figure 12). Then, using the DOWN arrow key, move the cursor to "Modem Config," press ENTER, and, if no modem has been pre-configured, a screen like that shown in Figure 13 will appear. If someone has already configured a modem, you will see a screen like the one shown in Figure 15, but you should still read the following information about list boxes.

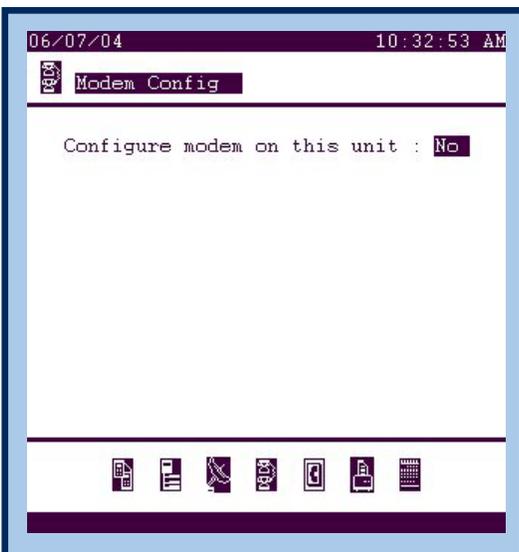


Fig. 13 Modem configuration: first screen



Fig. 14 Begin modem set up

In the modem configuration screen (Figure 14), press the UP ARROW and the cursor highlights a field, and the field contains the word "No." We'll assume your system will have a modem for communications off site, so press the Edit +/- key (directly under the "7 PQRS" key); when you do this, the field to the right of the question will become a list box, one of the main devices used in configuration. Whether a list box contains two possible responses, like the one in Figure 14, or more than a dozen, selection is made by moving the cursor with the arrow keys to the desired response and then pressing ENTER. If you are configuring a modem for the system, move the cursor to "Yes" in the list box and press ENTER. The result is a screen like Figure 15.



Fig. 15 The modem settings screen

The screen (Figure 15) will contain the factory default settings, and should not be changed without conferring with Danfoss technical support.

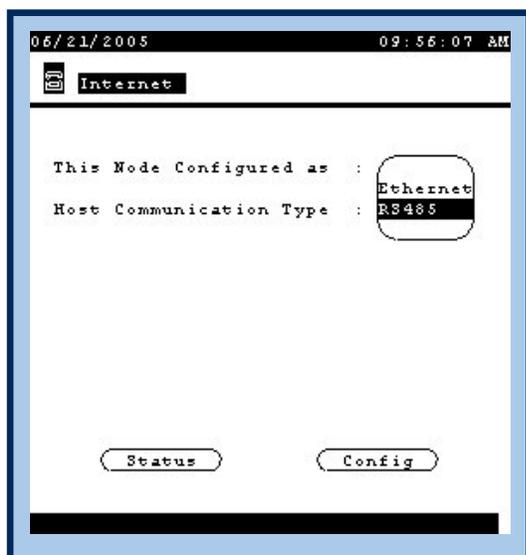


Fig. 16 Internet(Ethernet) configuration selection

Internet (Ethernet) Communications

Installers should determine from the system owner if Internet configuration will be necessary. If it is, then select "Communications" from the main menu, press ENTER, and when the communications menu (Figure 12) appears, select "Internet" and press ENTER. An Internet selection menu screen (Figure 16) appears.

Move the cursor to "Ethernet" in the list box and press ENTER.

Now move the cursor to the "Config" button at the lower right of the screen and press Enter. The Configure Internet screen that will appear looks like the example in Figure 17.



Fig. 17 Internet configuration screen

The fields that need configuration in the Configure Internet screen (Figure 17) are “Yes-No” list boxes and label fields. The owner’s IT department will supply the information needed for all the fields on the screen. If the system owner uses the Internet to communicate with stores, you will need to enter appropriate address information.

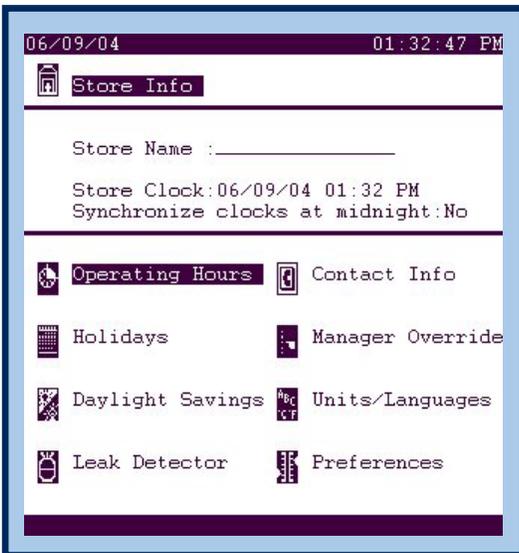


Fig. 18 The store info menu

Configuring store information

It is important, especially for alarms, communications, and schedules, to enter and check some items on the “store info” menu. To get there, go to the “main menu,” move the cursor to “store info,” and press ENTER. The store info menu looks like the screen in Figure 18.

The store name: a label field

The “Store Name” field is a *label entry field* that allows text entry from the keypad.

How label fields are edited

When you move the cursor to a label field like the “Store Name” field, the field initially appears as in Figure 18, with the first space an underscore and the remaining spaces dark. Then, when you press the EDIT+/- key, a box pops up like the one in Figure 20. Characters are entered or changed in the space by pressing one of the keypad’s number keys. For instance, if you press the “2” key, a “2” will appear in the space being edited; if you press the “2” twice, the character will change to an “A.” Press the “2” three times, and a “B” will replace the “A.” Press the “2” again, and a “C” will replace the “B.” If you press yet again, the “2” will reappear, and so on. When the character you want is in the space, press the right arrow to move to the next space, or the left arrow to move to the previous space.

When the label field contains exactly what you want, press ENTER to save the contents.



Fig. 19 The cursor in a label field



Fig. 20 Label field editing

Setting the controller clock

Lighting, defrosts, and other actions reference the time in the AK2-SC 255's clock. It is important to set the clock during installation. On the same screen, you can enter the store name if that has not been done earlier. Select "Store Info" from the main menu and press ENTER. The Store Info screen appears as in Figure 18, which is shown again at left. Move the cursor to the "Store Clock" setting field. To change the date and time, press the EDIT +/- key.

Use the keypad to enter the numeral you want in each space, and use the arrow keys to move left and right. Once the character you want in that space appears, use the right arrow to move to the next space (when the field has more than one space), and use the keypad to enter the next digit. When the date and time are as you want them to be, press ENTER.

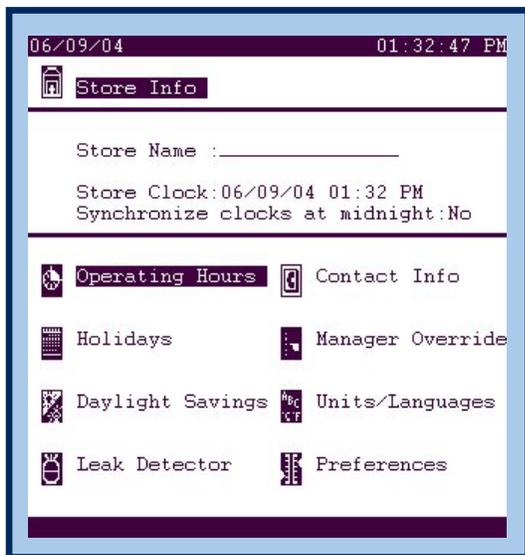


Fig. 18 (repeated) The store info menu (again)

Configuring Refrigeration, HVAC, Lighting, and the rest of the system

Except for communications, configuration has to be accomplished using menus and screens that are found by selecting "Configuration" from the main menu, then selecting the type of system to be configured. In the rest of this guide, we will use refrigeration as being representative of the way your controller is configured and functions. Begin refrigeration configuration by selecting "Configuration" from the main menu, then select "Refrigeration" from the configuration menu.

If no refrigeration has been configured, the initial refrigeration configuration screen will look like Figure 21. If some configuration has been done, the screen will list one or more racks, as in Figure 22. All refrigeration configuration, whether for suction groups, compressors, evaporators, condensers, etc., is reached through this screen. To add to the existing configuration, move the cursor to the name of a rack and press ENTER. If you need to add a rack to the existing system, move the cursor to the "Add Rack" button and press ENTER.



Fig. 21 Starting rack configuration when there is no prior configuration

Starting with a new rack will allow the most complete explanation of configuration. The same procedures described here can be used with a rack which has already been partly configured, but someone else will have already completed some of the steps.

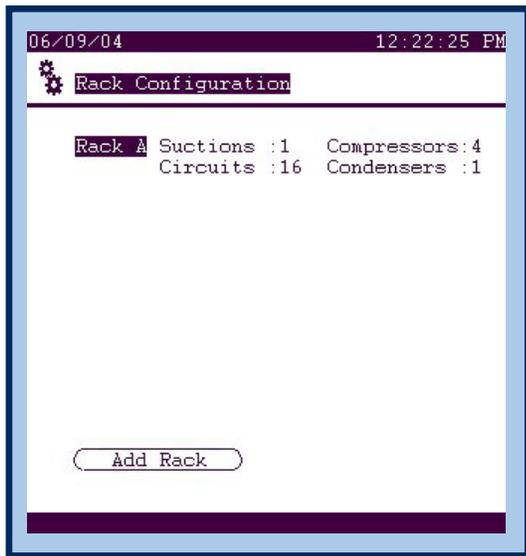


Fig. 22 Rack configuration menu when one rack has been previously configured

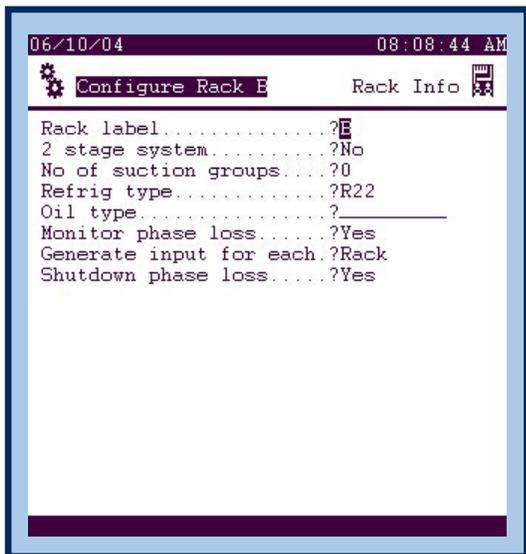


Fig. 23 Basic rack information

Adding a rack

Move the cursor to “Add Rack” and press ENTER. A screen will appear for a new rack. The name of the rack will be “Rack A” if there are no others configured, “Rack B” if this is the second rack, etc. The screen looks like the one in Figure 23. Move the cursor to the answer field following each question, answering the questions in turn with the new rack’s information.

Most of the configuration responses are list boxes, but some, like “No. of suction groups” require an entry from the keypad.

For every rack, there must be at least one suction group.

To supply a response, place the cursor on the field and press the EDIT+/- key. Use the arrow keys to select one of the items in the list box and press ENTER to save the selection. Some list boxes, like the one for “Refrig type,” have three dots at the bottom, indicating that the list is continued. If you don’t see the response you want in the initial list, move the cursor to the three dots and press ENTER, then make a selection from the remainder of the list. Remember to press ENTER to save your selection.

One of the responses in this screen, “Oil type,” is a label entry field. You should enter the type of oil (mineral, polyolester, etc). Use the technique described for entering the store name on page 10.

Continuing rack configuration

After you have entered the basic rack information required by the Rack Info screen, press ESC to return to the Configure Rack Menu, move the cursor to “Suction Info,” and press ENTER. Continue checking or adding new configuration information. You will notice that as you answer some questions, the response when you press ENTER will cause additional questions to appear on the screen, and may cause questions to disappear. This is because configuration is a dynamic process in which information is requested by the controller only as necessary.

Configuring the I/O devices

The I/O network consists of the AK2 I/O modules whose outputs turn devices on and off, and whose inputs monitor performance, either to tell whether devices are running or not, or to accurately indicate temperatures, pressures, and other analog levels throughout the installation.

Each I/O “point” or “channel” must be defined in the controller software.

The technician that installed and connected the I/O modules will have recorded the address of each I/O point connected to the controller you are installing. You or another technician will need to add this information to the controller configuration prior to start-up. If the controller came installed by a rack manufacturer, it is most likely that the configuration already includes address information for the compressors and sensors on the rack. What may need to be added is address information for the condenser, receiver, and refrigerated fixtures.

AK2 I/O addresses

AK2 I/O addresses each have 5 characters:

- a.) the communications module address: (2 digits) from 01 to 99.
- b.) the I/O module position: (1 digit) from 1 to 9.
- c.) the point number: (1 digit) from 1 to 8 (note that on combination modules, there are two sets of points, digital outputs and universal analog inputs, each set numbered from 1 to 8. One set is entered in the digital output board & point screen, and the other in the sensor input (analog or digital) board & point screen.

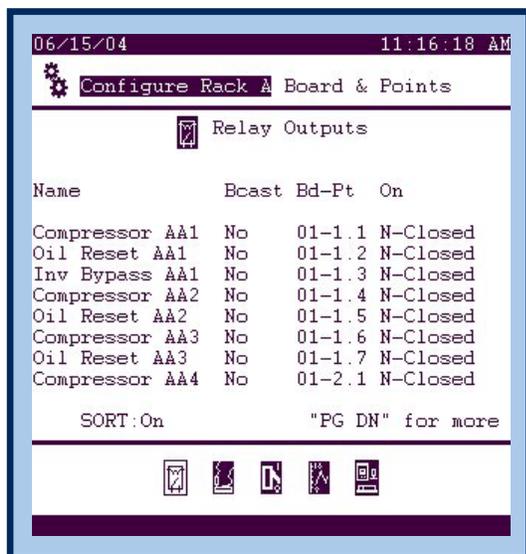


Fig. 24 A board and points screen

Looking at a Board & Points Screen

Before entering any I/O addresses (covered in the next section), let's look at a typical Board & Points screen. The term "Board" is legacy of earlier Danfoss systems. It is equivalent, for AK2 points, to "Module." We can observe a Board & Points screen as follows: After becoming authorized, start from the main menu; Select Configuration, press ENTER; Select a part of the system you to work with, in this case Refrigeration; press ENTER. Select a rack; press ENTER. Select Board & Points; press ENTER. The screen that you see will be something like the one in Figure 24.

The sample screen in Figure 24 already has I/O addresses entered for every listed point (they are in the column headed "Bd-Pt"). They would be present if a rack manufacturer addressed the outputs and sensors that were factory-installed. To make an entry in the board & point screen, you will need the address information that was recorded while installing the individual I/O modules.

The fields in the screen, and their meanings, are as follows:

Name (15 characters)

The name of the load connected to the digital output (relay output). The default names for the outputs automatically added during configuration of refrigeration are shown, and will suffice in many applications. They can be edited character by character (put the cursor on the field, press +/- to enter edit mode; then use the left and right arrow keys to move from space to space and the up and down arrow keys to select the character for that space. When the name appears as you want it, press ENTER).

Bcast (List box)

No: The value of the point will not be broadcast to be used in logic on other controllers.

Send: The value of the point (whether it is ON or OFF) will be available on the host network for use by other controllers. Be sure that each sending Board-Point combination is unique throughout the system. (If the controller at address #01 is sending from its Bd-Pt address 1-02, then no other controller can have an output at its Bd-Pt address 1-02 sending.)

Rec: The value of the point is being received from another controller on the host network. You must enter, in the Bd-Pt fields, the Bd-Pt address of the sending point.

Bd-Pt (Board Point)
First enter the address of the RO board and point to which the load is wired, or, in the case of a received broadcast point, enter the board and point address of the sending point.

On (List box)
N-Closed The load on this point is wired through its normally closed contacts.
N-Open The load on this point is wired through its normally open contacts.

SORT At the bottom of the body of the screen (above the icons, on the same line as "PG DN" for more is the SORT field. By default, sort mode is on, and entries will be sorted by Bd-Pt address; if sort mode is turned off, points from then on will be listed in order of creation. The sorting occurs when you press EXIT and will be apparent the next time you enter the screen.

Notice that "PG DN" appears at the bottom right of the screen. Whenever you see this on a screen, it indicates that the screen continues on another page. You will see the next page if you press the PG DN key on the controller keypad. (You can also place the cursor on "PG DN" and press ENTER).



Fig. 25 Icons as they appear across the bottom of a board points configuration screen

Icons

Beneath the body of the screen are five icons. These little pictures, from left to right, represent different types of I/O points:

Digital output (Relay Output)



These are control outputs that turn devices on and off. Notice that in the partial screen shown in Figure 24, this icon is black on white (normal video). Each type of point has its own screen. When that screen is the active one, its icon will be in normal video. All the other icons will appear in reverse video. Icons are selected by moving the cursor to them with the arrow keys and pressing ENTER.

Analog input (Sensor input)



These are inputs for sensors that measure variables such as pressure, temperature, humidity, etc.

Digital input (On-off input)



These are inputs that show whether a load is on or off.

Analog output (Variable output)



These outputs are for certain variable frequency drives, electrically operated modulating valves, certain damper motors, etc.

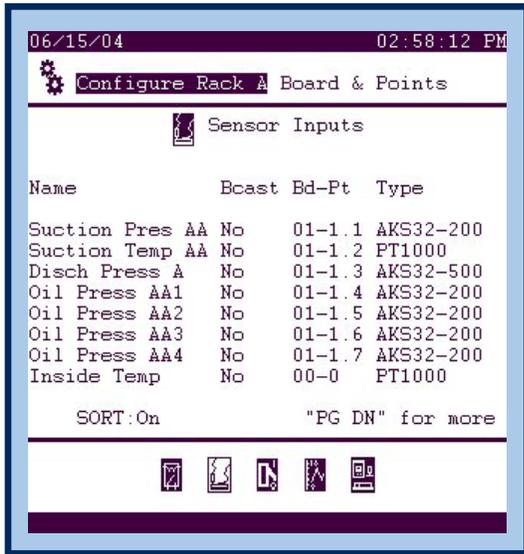


Fig. 26 Sensor input (analog input) board and points screen

Other controllers



These outputs are for case controllers and third party controls of types specified in the AK255 Reference Manual.

Adding new I/O devices

To see how address information is added, we will move to another screen, the analog input (sensor input) screen. From the digital output (relay output) screen, move the cursor to the second icon from the left and press ENTER. This will take you to the analog input (sensor input) screen, shown in Figure 26.

Notice that the manufacturer has configured most of the points. The last one, however, "Inside Temp," has no address, because the rack manufacturer did not install the sensor (inside temperature in this system is the temperature of the ambient air at a sensor mounted out on the sales floor).

Move the cursor to the address for the Inside Temp sensor, now reading "00-0." On the Board & Points screen, enter the four digit number you have for the point. The address is entered without any punctuation at all, but after the first two digits are entered, a hyphen will appear on the screen. Then, after the next digit, a point will appear. When all four characters have been entered, the point address will be in the same format as all the others on the screen.

This is the way configuration for each I/O address is entered using the controller keypad.



Fig. 27 The Main Menu

Checking System Status

After configuration and startup, you can use the extensive capabilities of the AK2-SC 255 controller to check equipment operation, observing pressures, temperatures, run times, and other information. There are many status screens accessible from the main menu. We will look at one area, the refrigeration configured in the examples in this Guide.

Refrigeration Status

Starting from the main menu (Figure 27), select Refrigeration and press ENTER.

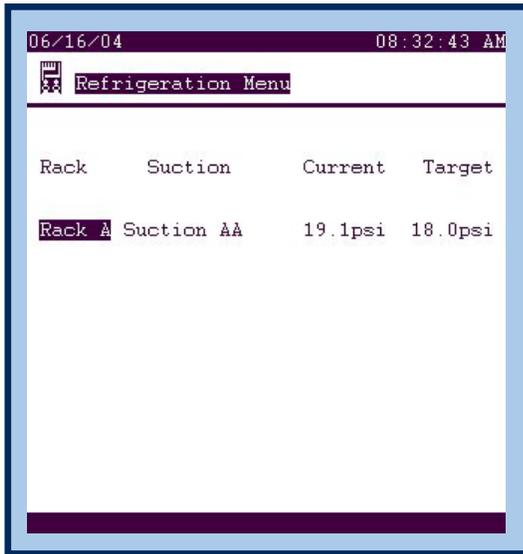


Fig. 28 The refrigeration menu

In an actual system there may be more than one rack configured per controller. The cursor, as in Figure 28, will be on the name of the first rack. When the cursor is on the rack you want to observe, press ENTER. The rack menu will look like the one in Figure 29.

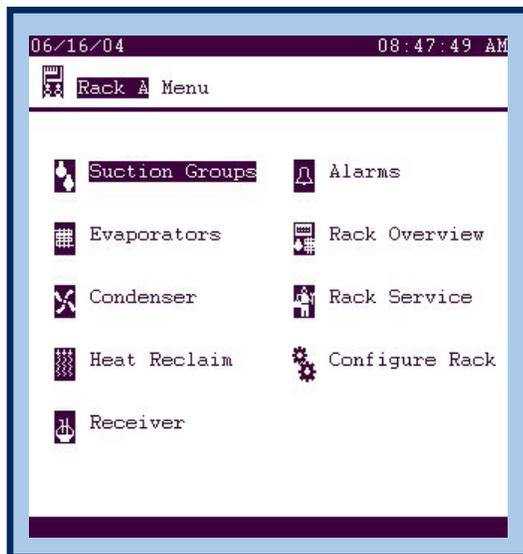


Fig. 29 The rack menu

The rack menu shows all the parts of the rack system. If a part of the rack is not configured, it will not appear on the menu. You can select any menu item to observe its status. Leaving the cursor on "Suction Groups," press ENTER. The suction group menu will appear as in Figure 30.

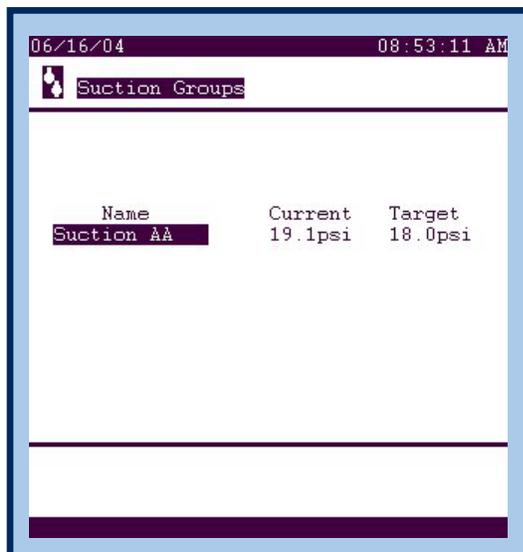


Fig. 30 A suction group menu

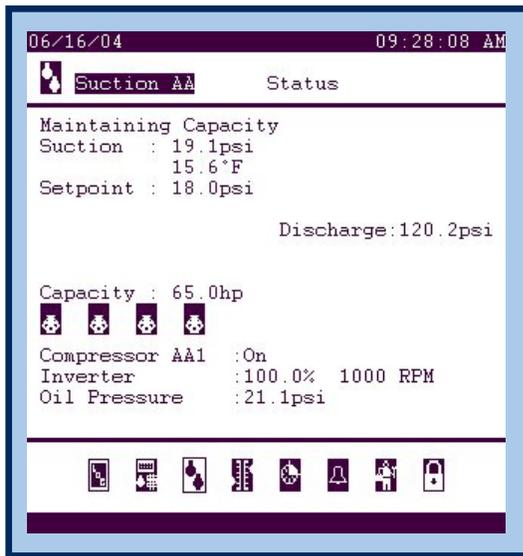


Fig. 31 A suction status menu

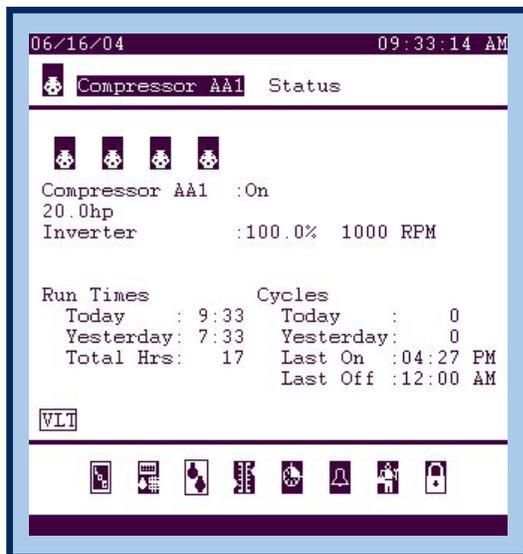


Fig. 32 A compressor status screen

Minimal information is given in the suction group menu (Figure 29), only suction pressure and target for each configured suction group on the rack. To see more detailed information, move the cursor to the suction group you want to see, and press ENTER. The suction status screen appears as in Figure 31. The information presented is straightforward.

The compressor icons (beneath the “Capacity” information) are in motion if the particular compressor is being asked to run. Also, if you place the cursor on one of the compressor icons and press ENTER, a compressor status screen will appear as in Figure 32.

In the compressor status screen (Figure 32), detailed performance information is given for the selected compressor. At the top of the screen body, icons appear for all the compressors on the rack to indicate if they are running. In this example, we are looking at a compressor that has a variable speed drive (inverter), and inverter performance information is also present.

Navigational Icons

Across the bottom of most status screens is a row of icons. When you select an icon and press enter, you will be taken directly to the screen the icon represents, without having to navigate through the menu structure. Here, the icons and their meanings pertain to the operation of the suction group:

History



This icon will take you directly to extensive history data for points that have been configured. The history points, unless altered by an authorized person, will include every controlled device, pressures, temperatures, etc. Other specialized history such as floating targets can also be entered.

User defined screen



Here the user can select a list of any of the configured points to monitor.

Suction



Returns to the suction status screen.

Settings



This icon leads to a screen where, with proper authorization, you can change set points and other operating parameters.

Schedules



This icon takes you to a schedules screen if one is applicable (which it is not here). Schedules are used for defrosts, lighting, HVAC, etc.

Alarms



Here you will see any active alarms in the system. Go to this screen when the word "Alarm!" is flashing in the date and time bar at the top of the screen.

Service



This icon leads to a menu from which a service technician can set relays and monitor inputs manually on or off, set and read maintenance hours accumulators for each compressor, adjusts sensor offsets, and find board & point locations conveniently.

Authorization



Leads directly to the authorization screen.

Further reference

A detailed technical reference manual for the AK2-SC 255 controller is available from the Danfoss Literature Department and on the Internet at www.acr.danfoss.com.

Technical support

For technical support beyond the scope of this Guide, contact Danfoss Technical Support at 410-931-8250.

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