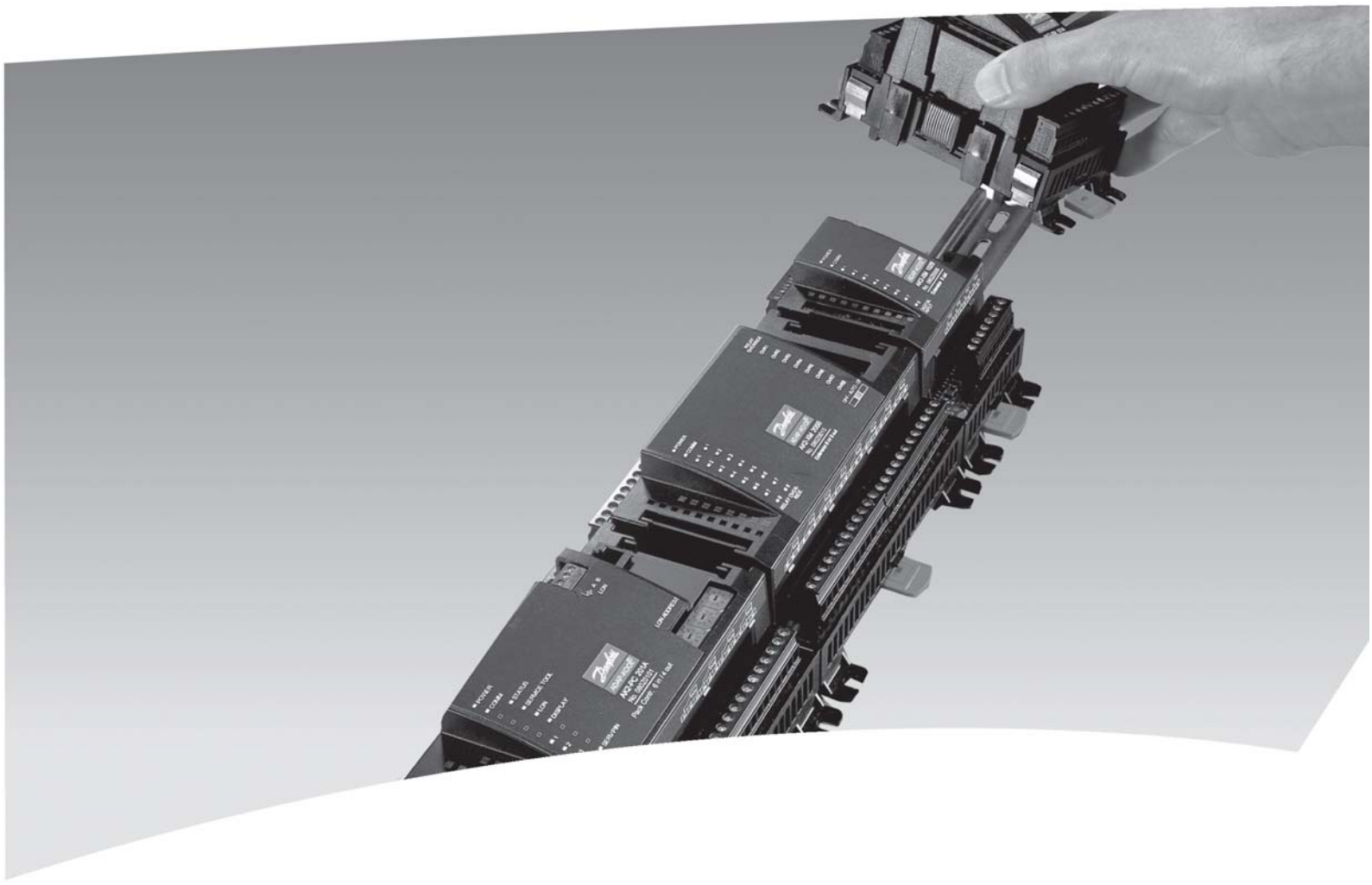


ADAP-KOOL®
AK2 Input-Output Modules

REFRIGERATION AND
AIR CONDITIONING

User manual

Table of Contents

Installing AK2 Modules

The AK2 series of I/O modules form lineups, with each lineup having a single user-addressed communications module and up to nine self-addressing I/O modules of any assortment. These lineups become groups of nodes on an AKC 55-based supermarket control and monitoring system. The modules are physically linked by means of connectors at each end of each module. The connector holds the modules together and makes the electrical connections between them. All power and network connections are made through the module connectors, with only the communications module in each lineup having a power cable and a network cable to the system's I/O network.

Fuses

Each module has a black cover with an identification label. There are fuses in the communications modules and in modules that have digital outputs. The fuses are reached by removing the module cover. Except for the fuses, there are no user adjustments or user serviceable parts in the modules, and when modules are in service, the covers should always be in place.

The types of AK2 I/O modules are the following:

Module name	Description	Inputs and outputs provided	Power
AK2-CM 101A	communications module		
AK2-XM 204A	digital output module	8 relay outputs	3.0 W (3.7 VA)
AK2-XM 205A	universal analog input & digital output module	8 relay outputs, 8 universal inputs	3.9 W (4.8 VA)
AK2-XM 101A	universal input module	8 universal analog inputs	1.3 W (1.5 VA)
AK2-XM 102A	digital input module (low voltage)	8 digital inputs, 9-80Vac or Vdc	1 W (1.25 VA)
AK2-XM 102B	digital input module (high voltage)	8 digital inputs, 80-260Vac	0.8 W (1.0 VA)
AK2-XM 208B	Bipolar stepper output module	4 bipolar stepper outputs	0.8W (1.0 VA)

[Stepper module requires a second separate 24 Vac power source (Danfoss IOPS) for valve drive power. See installation section of this manual.]

AK2 module names contain information about their use and size. A module containing the letters "CM" is a communications module. One containing the letters "XM" is an extension module. The last grouping of 3 or 4 characters in the name specifies the exact type of module. The first digit of the last group indicates the width of the module: 1for a half-width module and 2 for a full-width module. The remainder indicates the exact nature of the module.

Communications

The AK2-CM 101A communications module is available with 3 types of Echelon® transceiver: TP78, EIA 485, and FTT. The TP78 protocol is required for AKC 55 systems. Each physically separate lineup of I/O modules requires a communications module.

In locating the communications module, remember that the total length of all cable runs from an AKC 55, including stubs, is limited to 5000 feet.

A single communications module will support up to 9 I/O modules.

Power supply

Use only a galvanically isolated class 2 power supply. It is recommended that one of the 24 Vac Danfoss IOPS supplies be used, either the 30 VA or 56 VA version, depending on the total VA demand of the extension modules in the lineup. Part numbers for ordering IOPS power supplies are given on the last page of this manual.In selecting a power supply, be certain to check the total power requirements in VA using the table above.

When a Danfoss IOPS is used, it can be located up to 50 feet from the communications module it is powering.

Use 16 or 18 AWG wire when connecting power to the communications module.

Fuses

Fuses are reached by removing the module cover. Except for the fuses, there are no user adjustments or user serviceable parts in the modules, and when modules are in service, the covers should always be in place.

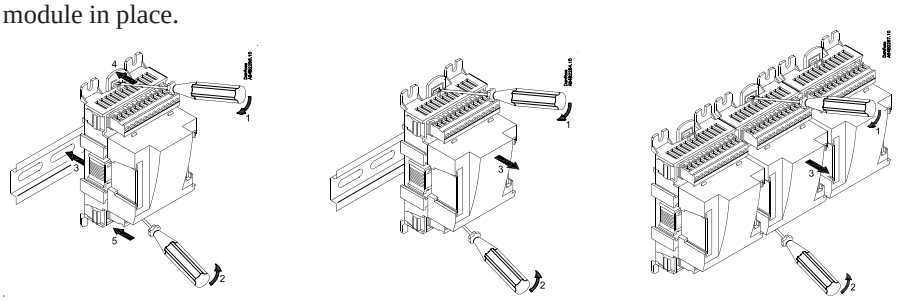
Mounting modules

All AK2 modules offer two mounting options: DIN rail mounting and screw mounting. All of the modules in a lineup must be mounted in the same way.

DIN rail mounting

For DIN rail mounting, first mount the rail with a minimum of 2 1/4 inches clearanceon each side. Open the first module's red tabs by using a small screwdriver as shown in the drawings below until the tabs snap open. Then position the module by slipping it over the rail, hold it in place, and press the red tabs. The module will be securely mounted.

To mount the second and subsequent modules on a DIN rail, open the red tabs as shown below. Position the new module so that the connectors are engaged, and gently push the module toward the rail until it is seated. Then press the red tabs to release them and lock the module in place.



Screw mounting

When mounting on a flat surface with screws, mount the communications module first, using the screw slots. Then connect the first extension module and secure it is advisable to connect the modules first, then position the entire lineup of modules and mark the screw holes. After drilling the holes, mount with panhead screws or bolts.

Installing a communications module

Cabling requirements

A communications module has one of three types of transceiver (TP78, EIA 485, or FTT). The AKC 55 I/O network uses the TP78 protocol. ***In an AKC 55 system, communications modules with TP78 transceivers (code number 080Z0061) are required.*** No other type of communications module will function.

Use 20 to 24 AWG stranded twisted shielded, Belden 9841, 9464, 9461, 8762, 8761, or equivalent.

Place a terminator across the network terminals on the last communications module on any cable run from the AKC 55.

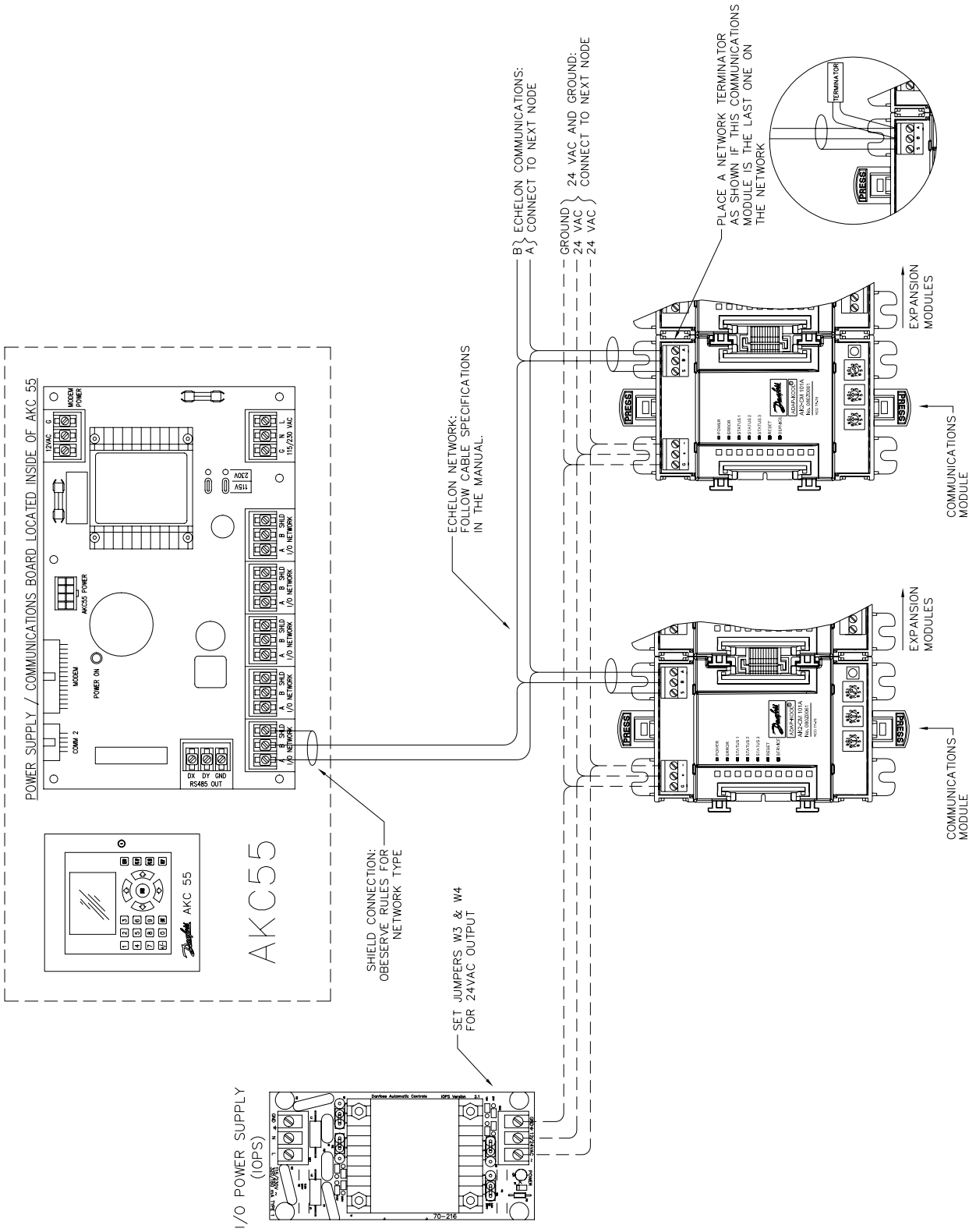
Use the drawing on the facing page for reference while wiring to an AKC 55 system.

Other transceiver types

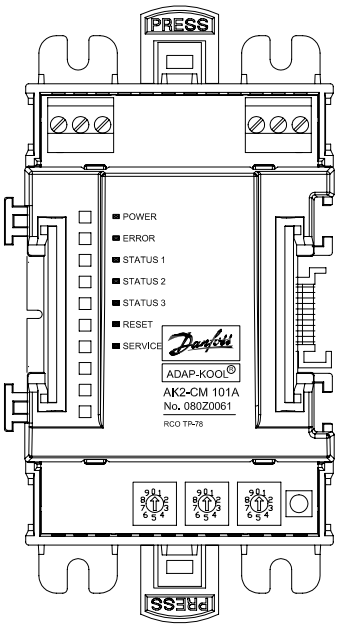
The communications module, when not used with AKC 55 systems, is available with two other transceiver types. Those types, and their cabling requirements, are:

FTT transceiver, Code number 080Z0062
Use 16 AWG stranded twisted, Belden 85102 or equivalent.
Do not use shielded cable with this transceiver.

EIA 485 transceiver, Code number 080Z0063
Use 20 to 24 AWG stranded twisted shielded, Belden 9841, 9464, 9461, 8762, 8761, or equivalent.


POWER SUPPLY / COMMUNICATIONS BOARD LOCATED INSIDE OF AKC 55
AKC 55
AKC55
I/O POWER SUPPLY (IOPS)
SHIELD CONNECTION: OBESERVE RULES FOR NETWORK TYPE
SET JUMPERS W3 & W4 FOR 24VAC OUTPUT
ECHELON NETWORK: FOLLOW CABLE SPECIFICATIONS IN THE MANUAL.
B} ECHELON COMMUNICATIONS:
A} CONNECT TO NEXT NODE
GROUND } 24 VAC AND GROUND:
24 VAC } CONNECT TO NEXT NODE
PLACE A NETWORK TERMINATOR AS SHOWN IF THIS COMMUNICATIONS MODULE IS THE LAST ONE ON THE NETWORK
TERMINATOR
EXPANSION MODULES
COMMUNICATIONS MODULE
EXPANSION MODULES
COMMUNICATIONS MODULE

Make sure to follow all the steps in the instructions that follow.



Addressing

Using the rotary ID switches shown at lower right in the illustration, set the communication module's unique address (from 001-099). Any number can be used as long as it is not used on any other communication module in the system.

Network connection

Using 20-24 AWG shielded stranded twisted pair cable, connect the communications module to one of the I/O network terminal blocks on the host AKC 55 rack controller. A communications module can also be connected in a "daisy chain" to the network terminals of another node on the AKC 55's I/O network. There is no need to observe any particular polarity with the A and B wires when making network connections.

Connect the shield to the terminals marked "shield" at both ends of every TP78 communications cable.

If the communications module is the last unit on the cable run, place a network terminator across its A and B terminals. Network terminators are supplied with an AKC 55, across each set of "NETWORK" terminals. If you are rebuilding an I/O run, you should find a terminator across the A-B terminals of the last node on the network.

Power connection

With main power to the communications module interrupted, connect the 24V terminals and ground of the power supply to the three corresponding terminals of the communications module. Make sure to use a supply with a VA rating adequate for the modules being connected. Module power ratings are given on page 3.

Wiring of the communications module is now complete.

Inspection of the installed Communication module

When a communication module is ready for operation, you should be able to observe the following, proceding clockwise around the module from the power terminal strip:

1. Power connections have been made.
2. Address switches have been set to a valid unique address from 001 to 099.
3. Connection has been made to an I/O network terminal of an AKC 55 at the "NETWORK" terminals, or to the network terminals of another node on the AKC 55's I/O network.

4. If this module is the last node on an I/O cable run, make sure that it is terminated by using one of the terminators supplied with the AKC 55. The terminator should be placed across the A and B terminals at the network connection on the communication module.
5. If functioning is normal, the first five status LED states shown below under "***Error LED OFF***" will occur in order. The module will go through these states any time power is interrupted and reapplied.

Software configuration of I/O points is done from the AKC 55 or a PC, and is covered in the section titled "Configuration."

Error and Status LEDs

The Error and Status LEDs indicate the following conditions when there is power to a communications module on the I/O network and a lineup of I/O modules is connected:

Error LED OFF	***Status LEDs ON***	***Meaning***
	1	(briefly) Powering up.
	2	Local bus initialized, waiting for host acknowledgement
	3	Connection to host established. Receiving configuration.
	1, 2, 3	(briefly) Communications module configured.
	1 blinking 2, 3 on	Running, all modules operational
Error LED blinking	1 blinking 2, 3 on	Running, one or more modules offline.

Error LED ON	***Status LEDs ON***	***Description***	***Possible cause***
	1	Automatic address assignment failed.	No working modules found; Module limit exceeded
	2	Unable to retrieve self-identification record from one or more modules.	Software error in one or more I/O modules
	3	Upper memory buffer boundary exceeded.	Maximum number of input points (80) exceeded
	1, 2, 3	Host communication timeout	Host AKC 55 is offline

Every hour, the communications module performs a check with all the extension modules in its lineup. During this check (less than 1/4 second) the ERROR LED on the communications module will light. This is normal and does not indicate any malfunction.

Installing an AK2-XM 204 digital output module

The AK2-XM 204 digital output module provides 8 fused digital outputs; each output can be wired to normally open (NO) or normally closed (NC) relay contacts. This module is available with or without override switches, and can be supplied in three terminal block variations: (1) without terminal blocks; (2) with Phoenix-type terminal blocks; and (3) with Euromate-type terminal blocks. Electrical data is found in the specifications toward the end of this manual.

Fuses

Fuses are reached by removing the module cover. Except for the fuses, there are no user adjustments or user serviceable parts in the modules, and when modules are in service, the covers should always be in place.

Mounting

Mount the module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Connecting loads

Observe the cautions stated above. Terminal blocks can be removed from the module for making connections.

Connections to the module are in groups of three as shown in the illustration. Each group has a C (common) screw numbered from 1 to 8, an NO (normally open) screw, and an NC (normally closed) screw. Wire each load to the module using a numbered group of 3 terminal screws. Connect each load to common and to either NO or NC contacts.

Recording digital output information

For each digital output module, record the unique two-digit address of the lineup's communication module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the controlled load is wired. Also record a description of the point wired to the terminal (e.g. "compressor A1"). A form is provided with each new I/O module for this purpose. *You will need this information when configuring the host controller.*

When all connections are made, and after replacing the terminal block if necessary, reconnect power to the communications module.

Inspection of the installed digital output module

When a digital output module is ready for operation, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. The module is connected to a communication module, or to an existing lineup
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM ERROR LED is OFF.
6. The status LEDs are ON for each point whose output relay is energized, and OFF for each point whose output relay is de-energized.
7. The override LEDs reflect the status of the override switches. The LED should be OFF for each switch in the center AUTO position. The LED should be ON for each switch in the left OFF) or right (ON) position.

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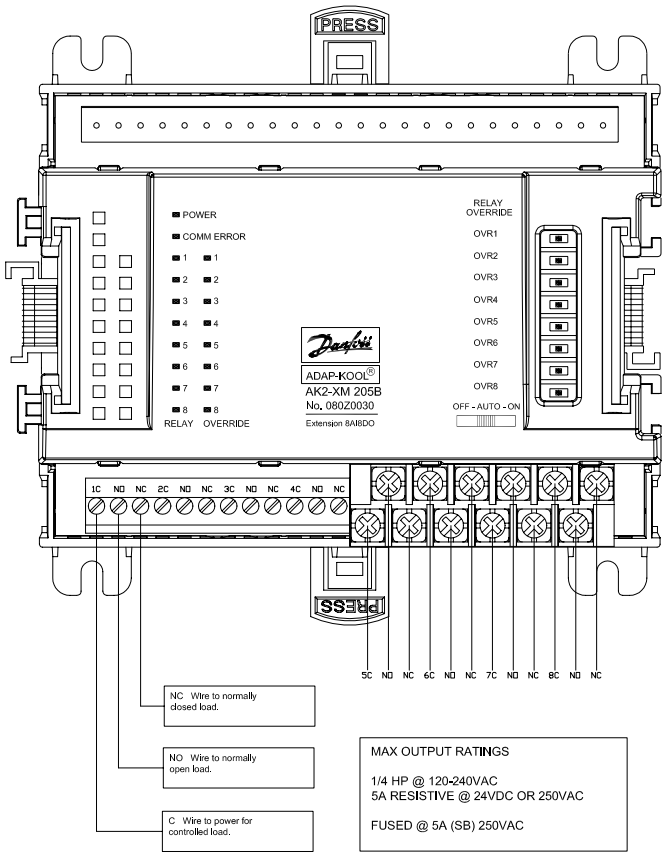


Status LEDs, relay states, and override switches

There are eight status LEDs, one for each output point. A status LED represents the state of the point's relay, and not necessarily the state of the device wired to that point. If the LED is ON, the relay is energized. With the LED ON, then, a device wired through normally closed (NC) contacts is OFF, because the normally closed contacts are open.

Refrigeration compressors, for example, are wired through normally closed (NC) contacts so that if power to the control system fails, and all the relays are de-energized, the control circuits for the compressors will be closed, and the compressors will run.

Override switches have logic in line with that of the status LEDs. When an override switch is put in the ON position, the corresponding relay is continuously energized; the LED will come ON; and any device wired through the normally closed (NC) contacts is forced OFF. If the same point were to have a device wired through it's normally open (NO) contacts instead, the LED would be ON and the device forced ON.

When an override switch is put in the OFF position, the corresponding relay is continuously de-energized; the LED will be OFF; and any device wired through the normally closed (NC) contacts is forced ON. If the same point were to have a device wired through it's normally open (NO) contacts isntead, the LED would be OFF and the device forced OFF.

Installing an AK2-XM 205A Combination Digital Output and Universal Analog Input Module

The AK2-XM 205A combination digital output and analog input module provides 8 fused digital outputs and 8 universal analog inputs. Each output load can be wired through normally open (NO) or normally closed (NC) relay contacts. This module is available with or without override switches and with two types of terminals, both of which can be seen in the illustration that follows. Excitation voltages for inputs are furnished at +5V and +12V.

Mounting

Mount the module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Digital outputs

Connecting loads

Loads are connected as described in the previous section for digital output modules. Connections to the module are in groups of three as shown in the illustration. Each group has a C (common) screw numbered from 1 to 8, an NO (normally open) screw, and an NC (normally closed) screw. Wire each load to be controlled to the module using a numbered group of 3 terminal screws. Connect each load to common and to either NO or NC contacts.

Recording digital input information

For each digital output on the combination module, record the unique two-digit address of the lineup's communi cation module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the controlled load is wired. Also record a description of the point wired to the terminal (e.g. "compressor A1"). A form is provided with each new I/O module for this purpose. *You will need this information when configuring the host controller.*

Universal analog inputs

The module's 8 analog inputs connect to the terminals opposite the relay output terminals. Each input can be either an analog or a dry contact digital input. High and low voltage input modules are separately available for sensing the presence or absence of current flows (e.g. compressor contactors).

Compatible sensors

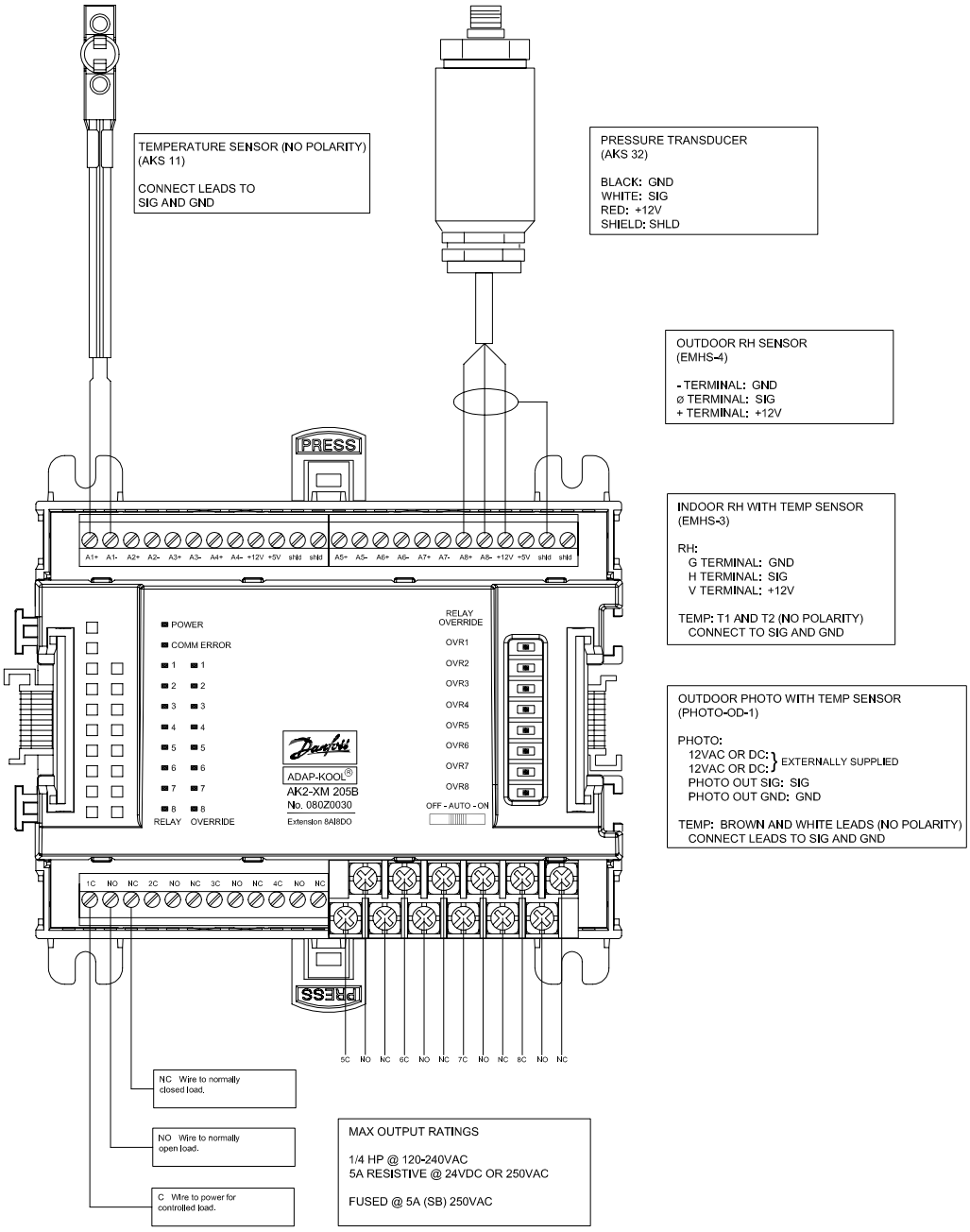
Sensor types that can be used with this module are the same as for the AK2-XM 101A analog input module, and will be found in the next section, which covers that module.

Connecting analog inputs

Connect analog inputs as shown on the facing page. Resistive sensors with two wires are connected like the temperature sensor shown at left, and sensors requiring an excitation voltage are connected like the pressure transducer shown at right.

4-20mA inputs

When connecting a sensor with a 4-20mA output, place a 250 ohm 1/4 watt precision resistor across the input terminals to be used.



Shielded cable

When sensor cables require a shield, connect the shield to one of the two terminals labeled "SHLD" at the end of each half of the terminal strip.

Dry contact inputs

Connect one side of a dry contact digital input pair to one of the terminals labeled "A+ (A1+, A2+, etc.) and connect the other to one of the A- (A1-, A2-, etc.) terminals for excitation. Remember to record that the input is a "DI" rather than an "AI." This information will be important when configuring the input at the host controller.

Recording sensor information

For each analog on the combination module, record the unique two-digit address of the lineup's communication module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the sensor is wired. Also record a description of the sensor wired to the terminal (e.g. "suction pressure compressor A1"). A form is provided on the reverse side of the form for the digital outputs for this purpose. *You will need this information when configuring the host controller.*

Inspection of the installed combination module

When a combination module is ready for operation, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. The module is connected to a communication module, or to an existing lineup
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM ERROR LED is OFF.
6. The status LEDs reflect the status of the output relays. The LED should be lit for each point whose relay is energized.
7. The override LEDs reflect the status of the override switches. The LED should be OFF for each switch in the center AUTO position. The LED should be ON for each switch in the left OFF) or right (ON) position.

Installing an AK2-XM 101A Universal Analog Input Module

The AK2-XM 101A half-width analog input module provides 8 analog inputs for sensors and dry contact digital inputs. Excitation voltages for inputs are furnished at +5V and +12V.

Mounting

Mount the module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Universal Analog inputs

The module's 8 analog inputs connect to the terminals on the top and bottom of the module enclosure. Each input can be either an analog or a dry contact digital input. High and low voltage input modules are separately available for sensing the presence or absence of current flows (e.g. compressor contactors).

Compatible sensors

The following types of sensors can be connected to the module:

Sensor name	*Sensor type*	*Sensor range*	*Remarks*
AKS 11	Temperature sensor	-58 to 212°F	
AKS 12	Temperature sensor	-94 to 320°F	
THERM 3	Temperature sensor		requires VR5-1 interface board
DPS100	Dewpoint sensor	0 to 100°F	
AKS 32-100	Pressure transducer	0-100 psig	
AKS 32-200	Pressure transducer	0-200 psig	
AKS 32-500	Pressure transducer	0-500 psig	
CT 12, CT 13	Current transducer	0-25, 0-50, or 0-75 A	
CT 14, CT 15	Current transducer	0-100, 0-150, or 0-200 A	
EMHS3	Humidity sensor	10-95% RH	
	with AKS 11 temperature sensor	32 to 120°F	
PHOTO-OD-1	Indoor-outdoor photo sensor	0 to 300 foot-candles	
ComTrol CTTS	Temperature sensor		requires CTP-KIT
ECI TP-1	Temperature sensor		requires CTP-KIT
ECI TP-2	Temperature sensor		requires CTP-KIT
CPC 501-1121	Temperature sensor		requires CTP-KIT

Connecting analog inputs

Connect analog inputs as shown on the facing page. Resistive sensors with two wires are connected like the temperature sensor shown at left, and sensors requiring an excitation voltage are connected like the pressure transducer shown at right.

4-20mA inputs

When connecting a sensor with a 4-20mA output, place a 250 ohm 1/4 watt precision resistor across the input terminals to be used.

Shielded cable

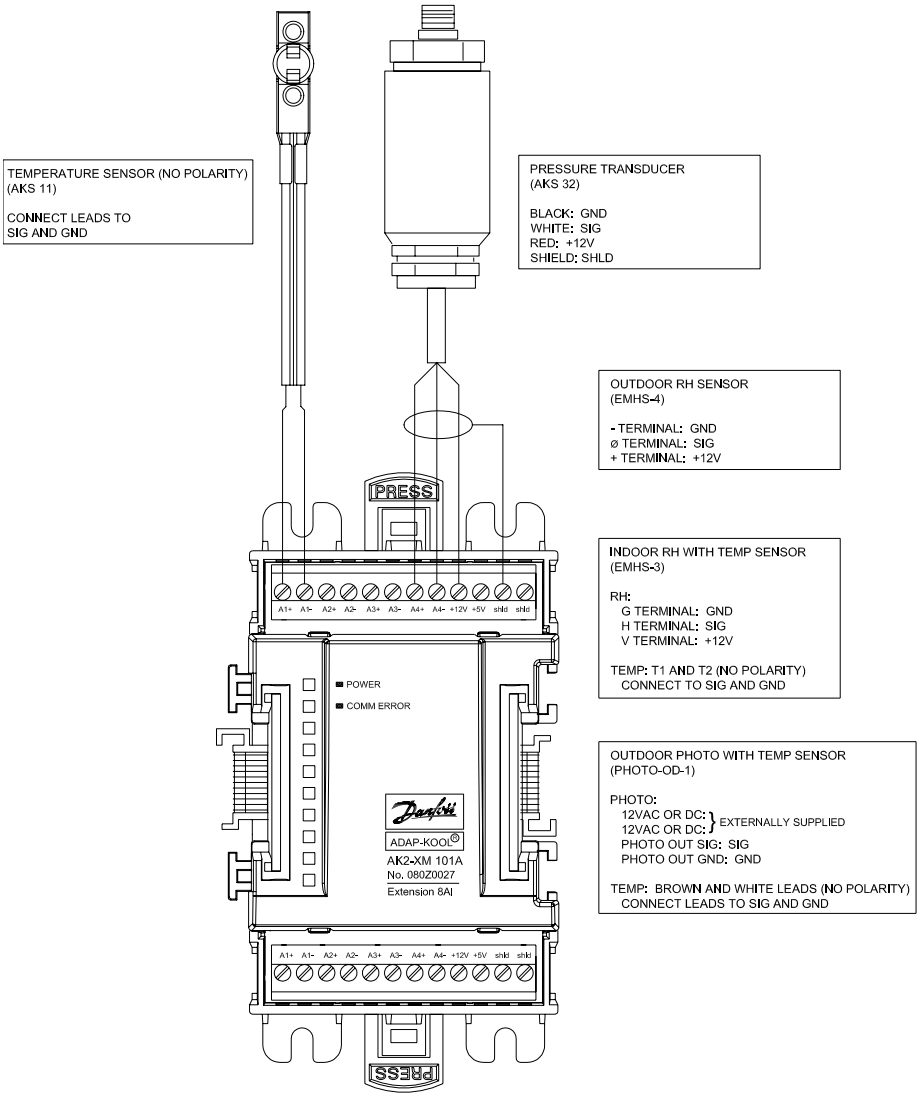
When sensor cables have a required shield, connect the shield to one of the two terminals labeled "SHLD" at the end of each half of the terminal strip.

Dry contact inputs

Connect one side of a dry contact digital input pair to one of the terminals labeled "A+ (A1+, A2+, etc.) and connect the other to one of the A- (A1-, A2-, etc.) terminals for excitation. Remember to record that the input is a "DI" rather than an "AI." This information will be important when configuring the input at the host controller.

Recording sensor information

For each set of terminals on the universal analog input module, record the unique two-digit address of the lineup's communication module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the sensor is wired. Also record a description of the sensor (e.g. "suction pressure compressor A1"). A form is providedwith each new module for this purpose. *You will need this information when configuring the host controller.*



Inspection of the installed universal analog input module

When a universal analog input module is ready for operation, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. The module is connected to a communication module, or to an existing lineup
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM ERROR LED is OFF.

Installing an AK2-XM 102A Low Voltage Digital Input Module

The AK2-XM 102A half-width low voltage digital input module provides 8 digital inputs rated at 9 to 80 Vac or Vdc.

Mounting

Mount the module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Digital inputs

The module's 8 digital inputs connect to the terminals at the top and bottom of the module enclosure.

Connecting digital inputs

Connect digital inputs as shown on the facing page.

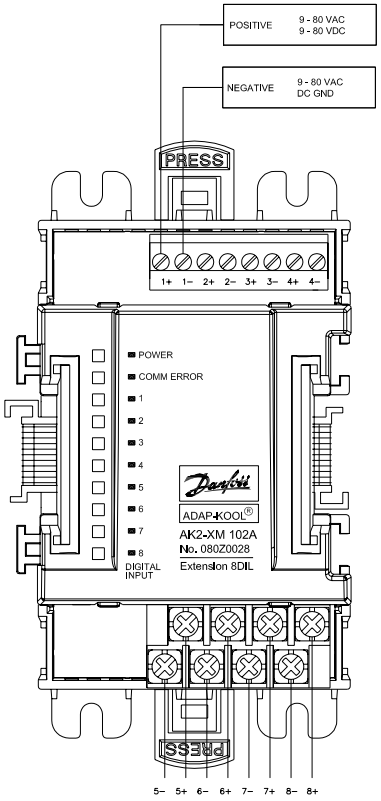
Recording input information

For each set of terminals on the digital input module, record the unique two-digit address of the lineup's communication module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the input is wired. Also record a description of the input wired to the terminal (e.g. "oil fail A1"). A form is provided with each new module for this purpose. *You will need this information when configuring the host controller.*

Inspection of the installed low voltage digital input module

When a low voltage digital input module is ready for operation, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. The module is connected to a communication module, or to an existing lineup
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM ERROR LED is OFF.
6. The status LEDs 1 through 8 correctly reflect the operating status of the equipment being monitored.


POSITIVE
9 - 80 VAC
9 - 80 VDC
NEGATIVE
9 - 80 VAC
DC GND
PRESS
1+ 1– 2+ 2– 3+ 3– 4+ 4–
POWER
COMM ERROR
1
2
3
4
5
6
7
8
DIGITAL INPUT
ADAP-KOOL®
AK2-XM 102A
No. 080Z0028
Extension 8DIL
PRESS
5– 5+ 6– 6+ 7– 7+ 8– 8+

Installing an AK2-XM 102A High Voltage Digital Input Module

The AK2-XM 102A half-width high voltage digital input module provides 8 digital inputs rated at 80 to 260 Vac.

Mounting

Mount the module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Digital inputs

The module's 8 digital inputs connect to the terminals on the top and bottom of the module enclosure.

Connecting Digital inputs

Connect digital inputs as shown on the facing page.

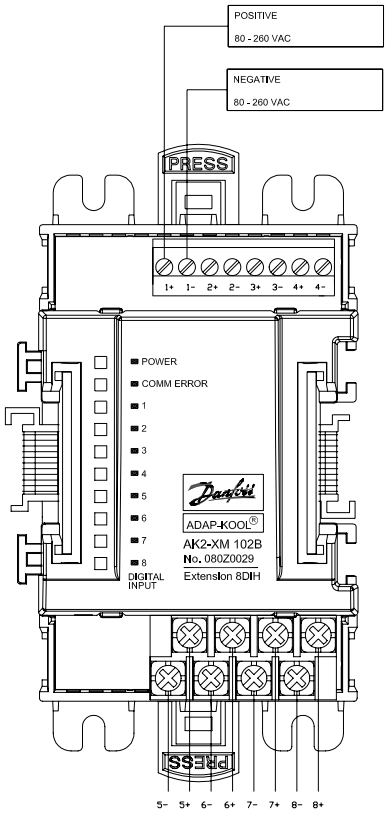
Recording input information

For each set of terminals on the digital input module, record the unique two-digit address of the lineup's communication module, the single digit location of the I/O module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which the input is wired. Also record a description of the input wired to the terminal (e.g. "compressor A1"). A form is provided with each new module for this purpose. *You will need this information when configuring the host controller.*

Inspection of the installed Low voltage digital input module

When a high voltage digital input module is ready for operation, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. Connection has been made to a communication module or to another module that is already connected to a communication module.
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM ERROR LED is OFF.
6. The status LEDs 1 through 8 correctly reflect the operating status of the equipment being monitored.


POSITIVE
80 - 260 VAC
NEGATIVE
80 - 260 VAC
PRESS
1+ 1- 2+ 2- 3+ 3- 4+ 4-
POWER
COMM ERROR
1
2
3
4
5
6
7
8
DIGITAL INPUT
ADAP-KOOL®
AK2-XM 102B
No. 080Z0029
Extension 8DIH
PRESS
5- 5+ 6- 6+ 7- 7+ 8- 8+

Installing an AK2-XM 208A EEPR stepper motor output module

The AK2-XM 208A EEPR stepper motor output module provides 4 bipolar outputs for control of stepper motor EEPR valves supplied by Danfoss and certain other manufacturers (see table below). This module is compatible with Danfoss AK2-SC 255 and AKC 55 system controllers.

The AK2-XM 208A EEPR stepper moter output module can be supplied in two: (1) without terminal blocks; (2) with Phoenix-type terminal blocks. Electrical data is found in the specifications toward the end of this manual.

Compatible valves

The AK2-XM 208A output module is compatible with the following stepper moter EEPR valves:

Danfoss	**Alco**	**Sporlan**
KVS 15-22	ESR 12 (12V)	CDS-8 (12V)
KVS 28-35	ESR 12 (24V)	CDS9 (12V)
	ESR 20 (12V)	CDS 16/17 (12V)
	ESR 20 (24V)	

Disconnect power from the lineup

Before installing any new module, disconnect power from the lineup's communication module. Do not reconnect power until by following these instructions, the installation, including the final inspection, has been completed.

Mounting

Mount the AK2-XM 208A module by connecting it to a communications module or to an existing lineup. Mounting instructions are supplied with the module and are also given in the earlier section of this manual about the communications module.

CAUTION

All safety precautions normally used when wiring control systems and high voltage equipment should be observed.

Disconnect power from the communications module before wiring any extension modules in its lineup.

Connecting leads from EEPR valves

Observe the cautions stated above. There are connectors for four valves on each module. Terminal blocks can be removed for making easy connection of wire leads from valves.

Each compatible EEPR valve has four leads: red, white, black, and either green or blue. Remove the terminal block from an unused valve position on the module. Loosen the connector screws. Now connect the valve leads to the terminal block in accordance with the key printed on the module housing.

Recording board and point information

For each EEPR control module, record the unique two-digit address of the lineup's communication module, the single digit location of the EEPR module (1 for the module next to the communication module, 2 for the next one, and so on up to 9), and the terminal number (point number) to which each EEPR valve's leads are wired. Also record a description of the valve wired to the terminal (e.g. "circuit B-4" or "meat cases system 22). *You will need this information when configuring the host controller for the new valve(s).*

Connecting 24 Vac valve power

Power to operate controlled EEPR stepper motors is provided through the AK2-XM 208B. Connect 24 Vac from a separate external Danfoss IOPS power supply to the power terminals on the AK2-XM 208B module. An external IOPS (56 VA) can supply up to 16 valves (using 4

AK2-XM 208B modules.

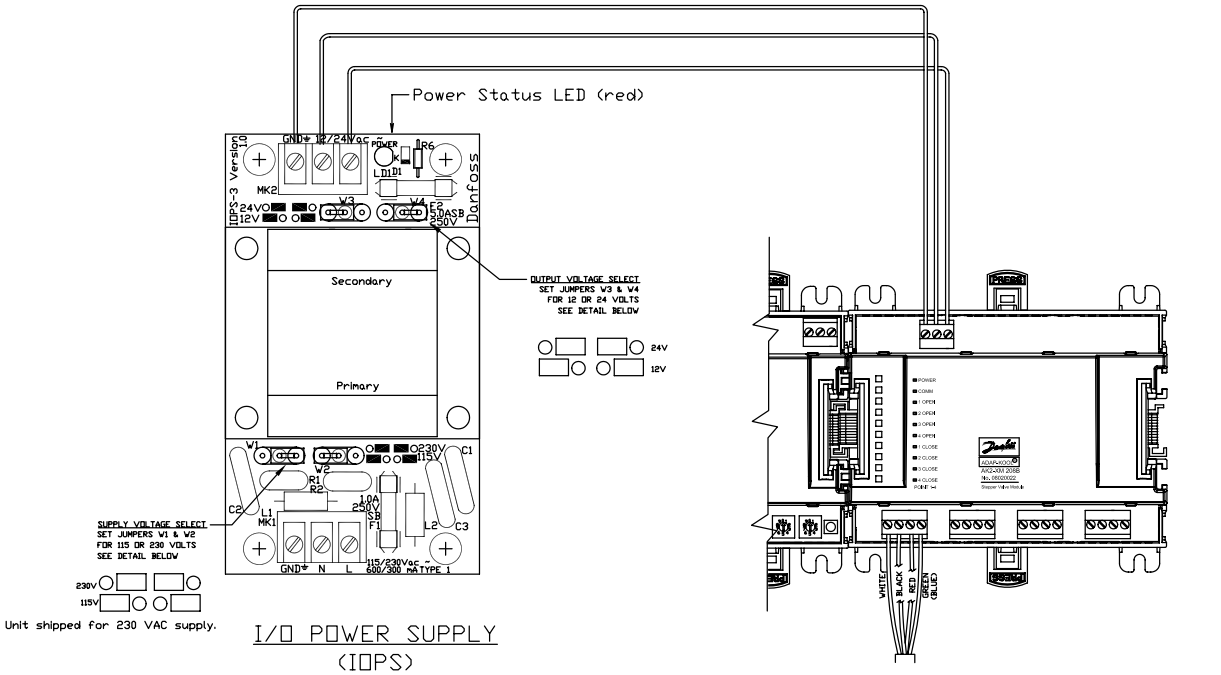
Reconnect power to the communications module

When all connections are made, and after replacing the terminal blocks to the module if necessary, reconnect power to the communications module. The AK2-XM 208A is now ready to configure.

Inspection of the installed digital output module

When physical installation of an AK2-SM 208B stepper EEPR control module is complete, you should be able to observe the following:

1. The module is securely mounted to DIN rail or to a flat surface.
2. The module is connected to a communication module, or to an existing lineup
3. Power has been reconnected to the communication module.
4. The POWER LED is ON.
5. The COMM LED is off. (It may blink initially until communication with the host controller is established. If steady on, seek support from Danfoss.)
6. The status LEDs should remain are ON for each point whose output relay is energized, and OFF for each point whose output relay is de-energized.



I/O POWER SUPPLY
(IOPS)
(56VA), Part No. 080Z0052

Bipolar stepper output module
AK2-XM 208B, Part No. 08020022

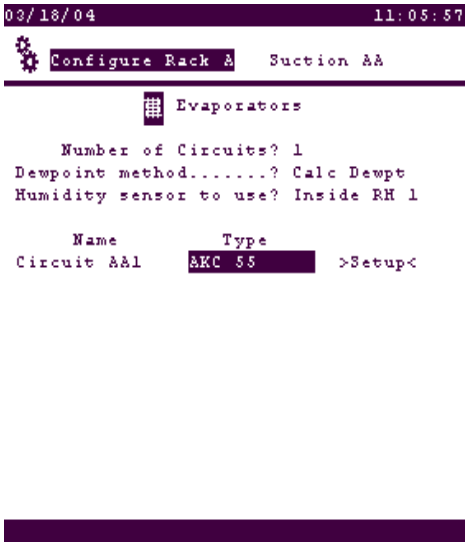
Configuring a Danfoss controller for an AK2-XM 208A EEPR stepper motor output module

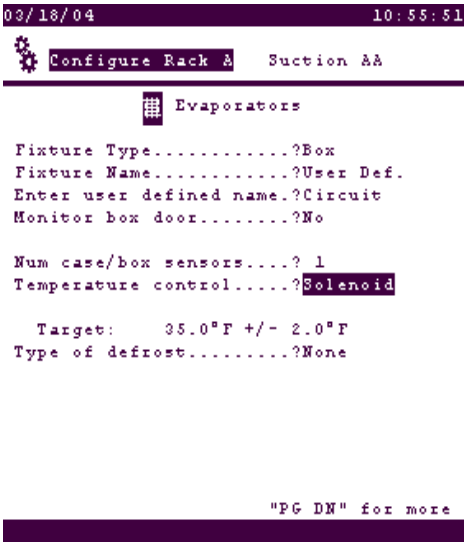
After installation of the hardware, host controller software must be configured for the type of valve to be controlled and for operational settings. Use the procedure that follows.

From the controller's Main Menu, select "Configuration."
From the Configuration Menu, select "Refrigeration."
From the Refrigeration Menu, select the rack with the EEPR valve you want to configure.
From the Configure Rack Menu, select the suction group. The Evaporator configuration screen will appear.

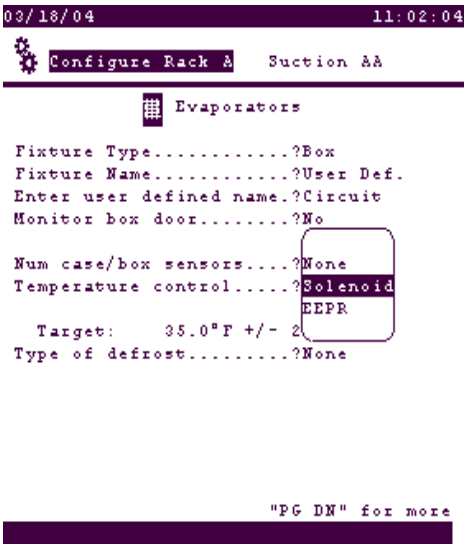
[note: There may be many evaporators. For the purposes of this explanation, we have created a suction group with a single circuit.]

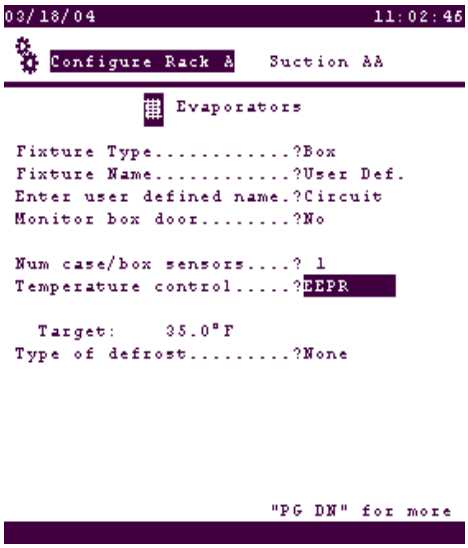
The Evaporator configuration screen appears at left below. EEPR configuration is an option under circuit type "AKC 55," so leave that field as is and select ">Setup<". The screen at right will appear, except that the cursor will be on the "Fixture Type" field..





Configure the fixture and sensor information as for any other circuit (using the procedures given in chapter 4 of the AKC 55 System User's Manual). Then move the cursor to the "Temperature control"field and press ENTER (or left click). A list box will open as shown at left below. Move the cursor in the list box to "EEPR" and press ENTER (or left click).The screen will appear as at right below.





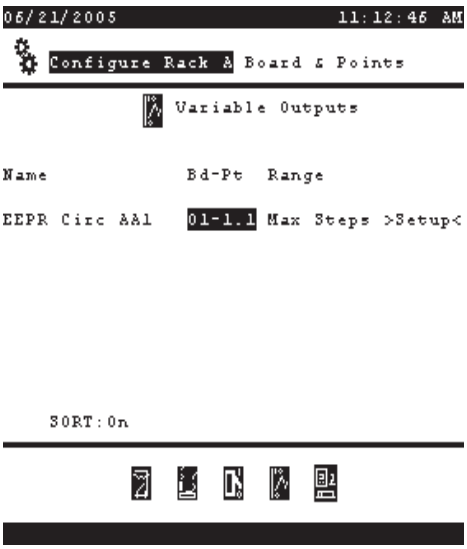
Notice that once EEPR is selected, the following “Target” line no longer shows a “+/-” value (often called a range or dead band), since no dead band is required for a a modulating valve like a stepper EEPR. Enter the target temperature.

Page down to the next page and specify defrost if any. If there is an entry other than “None, ” you will have to select a condition (Open, Closed) for the valve during defrost.

Board & Points Configuration

Return to the configuration menu, select Board & Points, and choose the icon for variable outputs. It is the fourth from left of the icons at the bottom of the screen. The screen that appears looks like the one at left below. Enter the board & point information (module address). In the sample screen, the address is 01-1.1. Yours will very likely be different.

Now select >Setup< and press ENTER, and the screen at right below will appear.



The settings in the “Stepper Setup” screen are determined by the type of valve that is being configured, and are given in the following tables. “Manual failsafe” is explained in the text following the tables. The sample has most of the data for a Danfoss valve, taken from the first line of the table. The table also contains information for other manufacturers’ valves.

Valve Type	Max steps	Step rate	Step hysteresis	Overdrive at Init	Max phase current	Max holding current
Danfoss KVS 15-22	4100	300/sec	0	10%	0.1	0
Danfoss KVS 28-35	5540	300/sec	0	10%	0.1	0
Alco ESR 12 (12V)	500 or 800**	50/sec	0	10%	0.41	0
Alco ESR 12 (24V)	501 or 800**	50/sec	0	10%	0.21	0
Alco ESR 20 (12V)	800	50/sec	0	10%	0.41	0
Alco ESR 20 (24V)	800	50/sec	0	10%	0.21	0
**For Alco valves, the "Max steps value depends on the date code of the individual valve. Valves manufactured before 2001 have 500 max steps. Also consult Alco technical documentation for details.						
Sporlan CDS 8	3064	200/sec	0	10%	0.215	0
Sporlan CDS 9	6386	200/sec	0	10%	0.215	0
Sporlan CDS 16/17	6386	200/sec	0	10%	0.215	0

Manufacturers may change valve specifications without notice. Always check the settings in the following tables against information provided with each new valve by its manufacturer, or contact the manufacturer's application engineering department for the information.

The fields in the EEPR Setup screen are as follows:

Max steps (0 to 10000) The number of steps that corresponds with 100% opening of the valve.

Step rate (0 to 500 /sec) The rate at which the valve motor must be driven.

Step hysteresis (0 to 127) When a gear-driven valve is at any given position, driving a number of steps to a new position, reversing direction, and then driving back the same number of steps, the valve may not return to the position it started from. This phenomenon occurs because of backlash in the gear train. To compensate, hysteresis is programmed, and works like this: When a valve is driven open to a target position, the controller will over-drive the valve by the hysteresis amount, then drive back in the closing direction by the same hysteresis amount. The effect is taht regardless of the net change in valve position (either more open or more closed), the last real direction for valve travel will also be in the closed direction. The hysteresis adjustment ensures that the valve train is always pre-loaded in the same direction, ensuring repeatability of valve position.

Overdrive at init (0 to 31 %) Stepper motor valves do not usually include a feedback mechanism to determine the actual mechanical position of the valve. Valve manufacturers, however, design their valves to be overdriven at complete closure without damage. The "Overdrive at init" value gives the additional amount, as a percent-

	age of “Max steps,” that the valve should be driven closed whenever we initialize the valve. Valve initialization occurs automatically whenever the AKC 55 is reset, whenever the AK2-XM 208A stepper motor EEPR control module is reset, and whenever the associated refrigeration circuit defrosts.
Manual failsafe	(0 to 100%) Determines the position, as a percentage of full open, that the valve will default to should communications fail between the AKC 55 and the communications module for the AK2-XM 208A’s lineup, or between the communications module and the AK2-XM 208A.
Max phase current	(0 to 1000 mA) Limits the current, and thus the power dissipation in the valve. Take care to set the value to the valve manufacturer’s specification. The module resolves the programmed value to the nearest 10 mA.
Max holding current	(0 to 70%) The percentage of “Max phase current” required by some stepper valves to hold the valve at its most-recently-achieved position. The module resolves the programmed value to the nearest 10%.
Valve in defrost	(List box: Closed, Open) the position the valve should maintain during defrost.

Configuration

The AK2-XM 208A requires Board & Points configuration as an analog output board in accordance with the information in the following section under “What’s different.”

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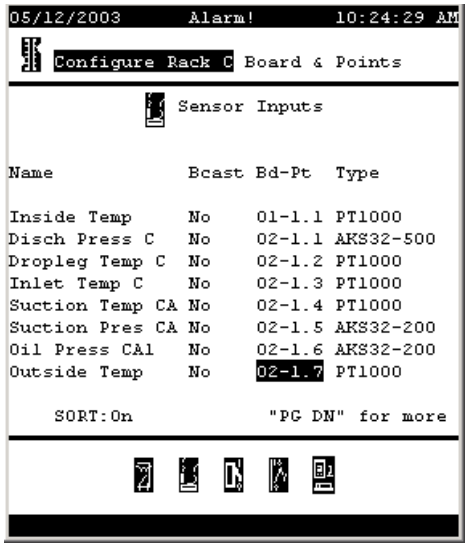
Configuring other AK2 I/O Modules in an AKC 55 System

Configuration of points on AK2 modules is almost exactly the same as for other points in an AKC 55 system. Consult chapter 4 of the AKC 55 System User’s Manual.

What’s different

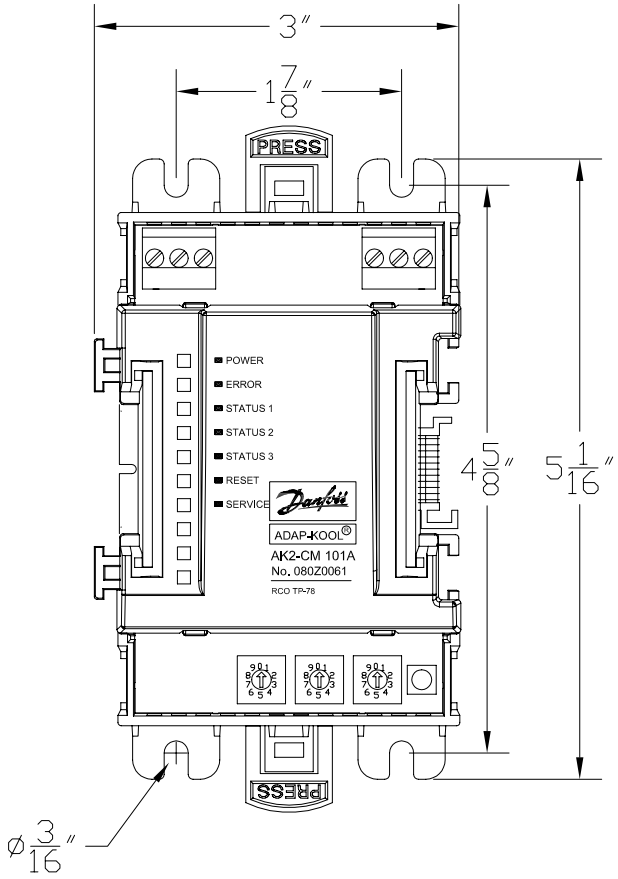
There is one difference in configuration. When entering the board and point information for an AK2 point, there are five characters to enter. That is why you recorded, for each point:
a.) the communications module address: (2 digits) from 01 to 99 (the leftmost switch is not used, and remains set to zero).
b.) the I/O module position: (1 digit) from 1 to 9
c.) the point number: (1 digits) 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 board & point screen).



To make an entry in the board & point screen, you will need the address information you recorded while installing the individual I/O modules.
On the Board & Points screen, enter (for each point) the two-digit communications module address first. A hyphen automatically appears. Then, enter the single-digit position number for the extension module, then the two-digit point number. The point number can be entered as “01” or as “.1” but the entry will always display as in the screen shown above.

Either three character configuration or four character board & point numbers will be accepted by the AKC 55, because traditional IO boards require three-character addresses as detailed in chapter 4 of the AKC 55 System User Manual, and AK2 points require the four-character addresses described here. If any other number of characters is entered, the entry will be rejected and zeros will appear.

Specifications – AK2-CM 101A communications module

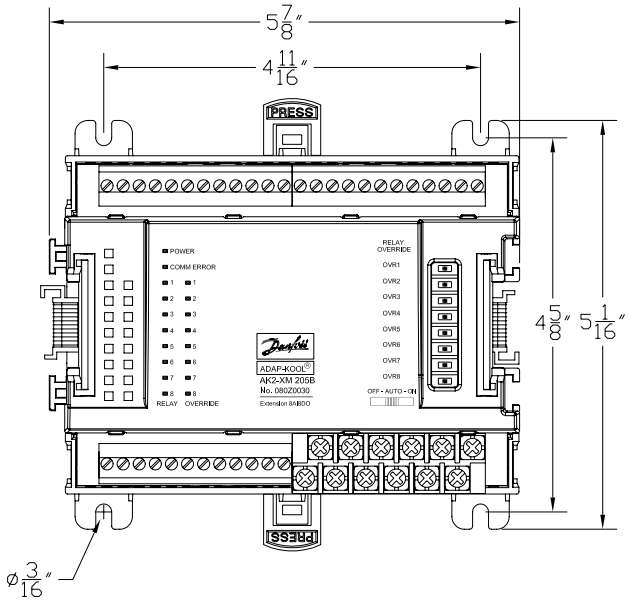


UL file number	E166834
Input voltage:	18-36 Vdc, 24 Vac ± 20%
Input power:	50 W (60 VA)
Input fusing:	3.15 A (SB) 250 Vac
Output voltage:	18-36 Vdc
Output power capacity	up to 45 W
IO module capacity:	up to 10
Power consumption:	0.8 W @ 24 Vdc 1.0 VA @ 24 Vdc

Operating temperature:
-4 °F to 131°F @ 0 to 95% RH (non-condensing)
Storage Temperature:
-40°F to 158°F @ 0 to 95% RH (non-condensing)

Compatible with 24 V battery backup systems.

Specifications – AK2-XM 204A digital output module
AK2-XM 205A combination digital output & analog input module



UL file number	E166834
General purpose relays:	8, form C
Universal inputs:	8
Relay rating:	1/4 hp 120-240 Vac 5 A resistive 24 Vdc or 240Vac
Device limit, outputs:	20 A
Relay fusing:	5A, 250 Vac
Sensor excitation	5 or 12 Vdc @ 100 mA
Excitation fusing	auto-reset, 200 mA
Power supply	18-36 Vdc, 3.6 W supplied by communications module

Power required to communications module:
3.9 W @ 24 Vdc
4.8 VA @ 24 Vac

Operating temperature:
-4 °F to 131°F (-20 to +55°C)
@ 0 to 95% RH (non-condensing)

Storage Temperature:
-40°F to 158°F (-40 to +70°C)
@ 0 to 95% RH (non-condensing)

Universal Inputs:

(a) Voltage

Resolution	1 mV
Accuracy @ 20°C	±4 mV @ 0-4 Vdc
Temp. Coeff.:	±0.4 mV/°C
Accuracy @ 20 °C	±10 mV @ 4-10 Vdc
Temp. Coeff.:	±1.4 mV/°C

(b) Resistive

Resolution	±0.1Ω
Accuracy	±1.2Ω @ 10-400Ω ±0.4Ω @ 400-1500Ω ±1.2Ω @ 1500-2300Ω ±2.0Ω @ 2300-2500Ω
Temp. Coeff:	±0.02Ω/°C, 10-1500Ω ±0.04Ω/°C, 1500-2300Ω

(c) Dry contact

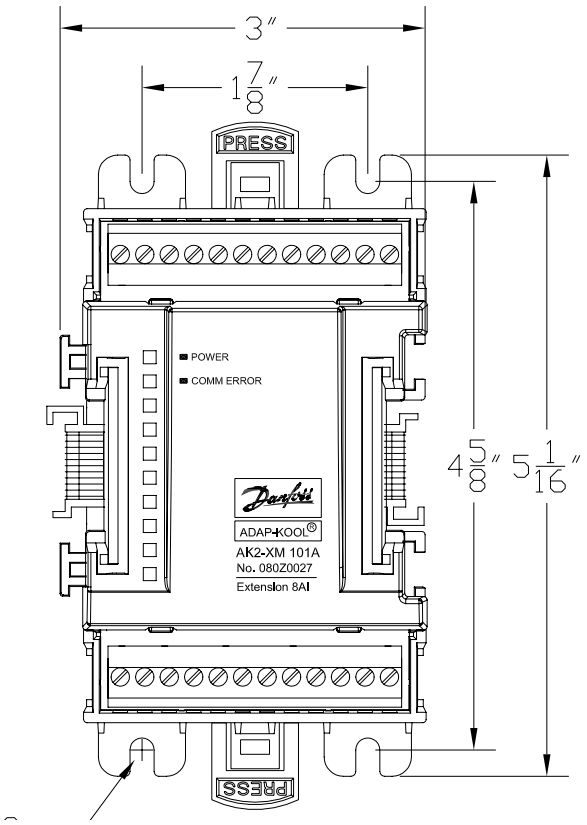
Contact cleansing current
120 mA for 0.1 msec.

Steady state current
10 mA

Closed when contact resistance < 200Ω

(d) Ratiometric sensor

Specifications – AK2-XM 101A analog input module



UL file number	E166834
Universal inputs:	8
Sensor excitation	5 or 12 Vdc @ 100 mA
Excitation fusing	auto-reset, 200 mA
Power supply	18-36 Vdc, 1.1 W supplied by communication module

Power required to communication module:
1.3 W @ 24 Vdc
1.5 VA @ 24 Vac

Operating temperature:
-4 °F to 131°F (-20 to +55°C)
@ 0 to 95% RH (non-condensing)

Storage Temperature:
-40°F to 158°F (-40 to +70°C)
@ 0 to 95% RH (non-condensing)

Universal Inputs:

(a) Voltage

Resolution	1 mV
Accuracy @ 20°C	±4 mV @ 0-4 Vdc
Temp. Coeff.:	±0.4 mV/°C
Accuracy @ 20 °C	±10 mV @ 4-10 Vdc
Temp. Coeff.:	±1.4 mV/°C

(b) Resistive

Resolution	±0.1Ω
Accuracy	±1.2Ω @ 10-400Ω
	±0.4Ω @ 400-1500Ω
	±1.2Ω @ 1500-2300Ω
	±2.0Ω @ 2300-2500Ω
Temp. Coeff:	±0.02Ω/°C, 10-1500Ω
	±0.04Ω/°C, 1500-2300Ω

(c) Dry contact

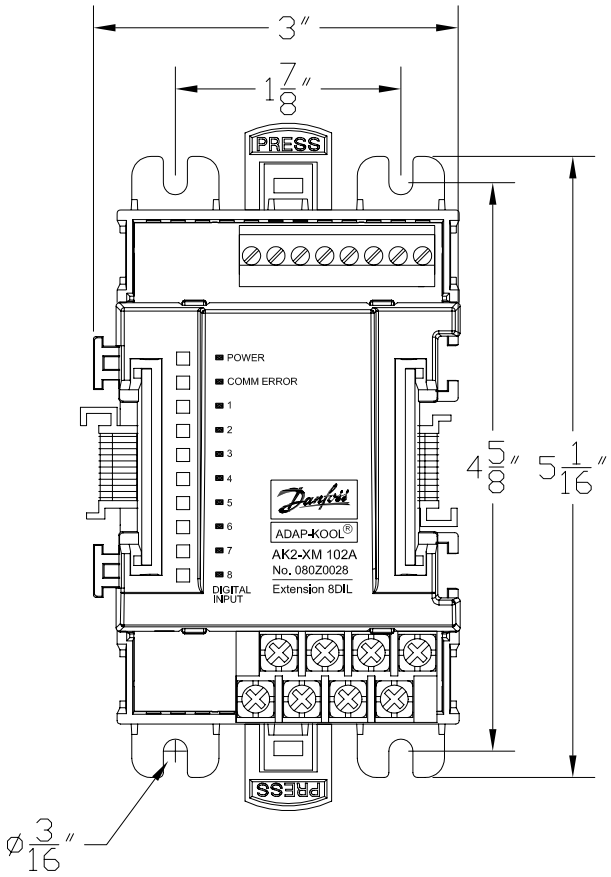
Contact cleansing current
120 mA for 0.1 msec.

Steady state current
10 mA

Closed when contact resistance < 200 Ω

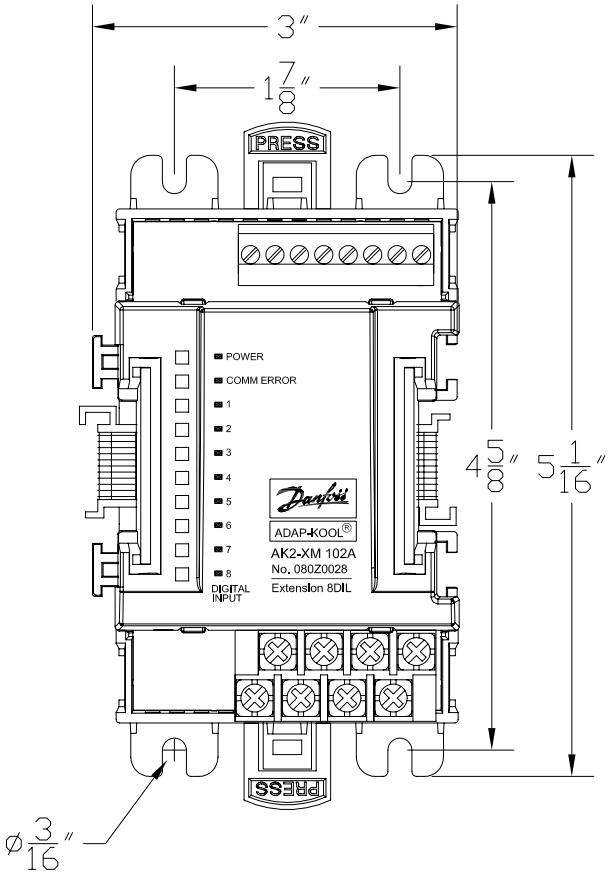
(d) Ratiometric sensor

Specifications – AK2-XM 102A digital input module (low voltage)



UL file number	E166834
Low voltage digital inputs:	8
Input rating:	9-80 Vac or Vdc
Power supply:	18-36 Vdc, 0.7 W supplied by communication module
Power required to communication module:	
	0.8 W @ 24 Vdc
	1.0 VA @ 24 Vac
Operating temperature:	
-4°F to 131°F (-20 to +55°C)	
	@ 0 to 90% RH (non-condensing)
-4°F to 104°F (-20 to +40°C)	
	@ 0 to 95% RH (non-condensing)
Storage Temperature:	
-40°F to 158°F (-40 to +70°C)	
	@ 0 to 95% RH (non-condensing)

Specifications – AK2-XM 102A digital input module (high voltage)



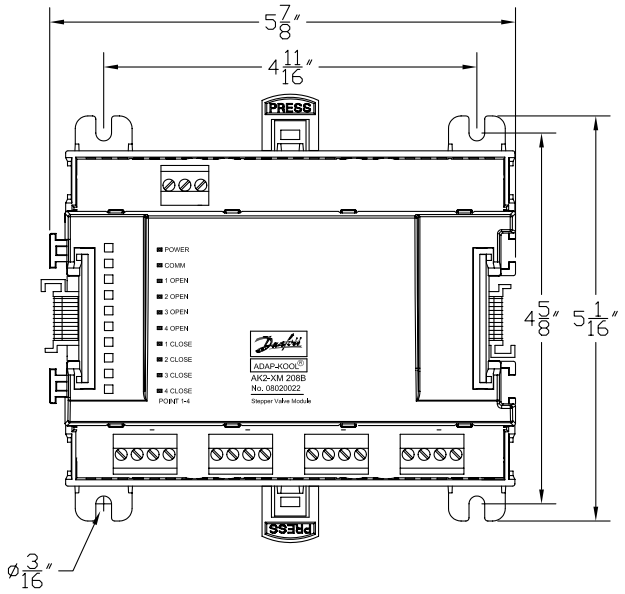
UL file number	E166834
Digital inputs:	8
Input rating:	95-260 Vac
Power supply:	18-36 Vdc, 0.7 W supplied by communication module

Power required, to communication module:
0.8 W @ 24 Vdc
1.0 VA @ 24 Vac

Operating temperature:
-4°F to 131°F (-20 to +55°C)
@ 0 to 90% RH (non-condensing)
-4°F to 104°F (-20 to +40°C)
@ 0 to 95% RH (non-condensing)

Storage Temperature:
-40°F to 158°F (-40 to +70°C)
@ 0 to 95% RH (non-condensing)

Specifications – AK2-XM 208B bipolar stepper output module



Bipolar stepper outputs	4
Input rating:	95-260 Vac
Power supply:	18-36 Vdc, 0.7 W supplied by communication module
Power required, to communication module:	0.8 W @ 24 Vdc 1.0 VA @ 24 Vac
Power supplied by module to operate valves:	13 VA @ 12 or 24 Vdc (brand dependent)

Operating temperature:
-4°F to 131°F (-20 to +55°C)
@ 0 to 90% RH (non-condensing)
-4°F to 104°F (-20 to +40°C)
@ 0 to 95% RH (non-condensing)

Storage Temperature:
-40°F to 158°F (-40 to +70°C)
@ 0 to 95% RH (non-condensing)

Code numbers for ordering

Communications Module
080Z0061 Communications module type AK2-CM 101A (Lonworks TP78)

Digital Output Modules
080Z0011 8 DO type AK2-XM 204A with Euromate terminal blocks
080Z0026 8 DO type AK2-XM 204A without terminal blocks
080Z0018 8 DO type AK2-XM 204A with override with Euromate terminal blocks
080Z0031 8 DO type AK2-XM 204A with override without terminal blocks

Combination Digital Output & Universal Analog Input Modules
080Z0010 8 DO, 8 AI type AK2-XM 205A with Euromate terminal blocks
080Z0025 8 DO, 8AI type AK2-XM 205A without terminal blocks
080Z0017 8 DO, 8AI type AK2-XM 205A with override with Euromate terminal blocks
080Z0030 8 DO, 8AI type AK2-XM 205A with override without terminal blocks

Universal Analog Input Modules
080Z0007 8 AI type AK2-XM 101A with standard terminal blocks
080Z0027 8 AI type AK2-XM 101A without terminal blocks

Digital Input Modules, High Voltage
080Z0013 8 DI type AK2-XM 102A with override with Euromate terminal blocks
080Z0029 8 DI type AK2-XM 102A with override without terminal blocks

Digital Input Modules, Low Voltage
080Z0008 8 DI type AK2-XM 102B with override with standard terminal blocks
080Z0028 8 DI type AK2-XM 102B with override without terminal blocks

Stepper Motor EEPR Valve Analog Output Module
080Z0022 8 bipolar EEPR AO type AK2-XM 208B

Power Supplies
080Z0051 30 VA type IOPS
080Z0052 56 VA type IOPS