

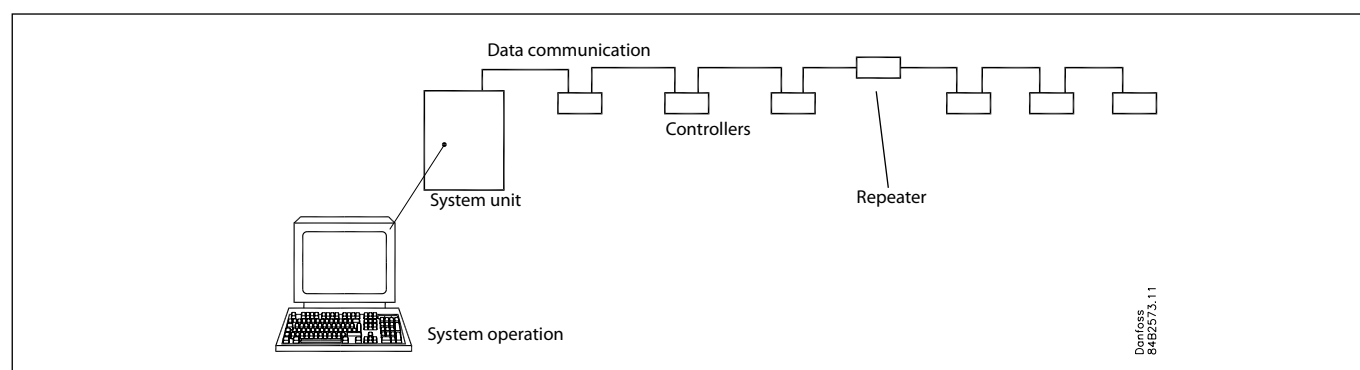
Data communication between ADAP-KOOL® Refrigeration Controls

Introduction

This installation manual covers the data communication systems installed in Danfoss refrigeration control systems.

The manual describes the data communication interface with the relevant controllers and the communication systems that Danfoss uses.

The recommendations mentioned in this document are intended as instructions for the market's refrigeration engineers and electricians who install Danfoss refrigeration controls.



The guide describes:

- The various forms of communication
- Cable to be used
- Length of cable
- Termination of cable
- When to install a repeater and
- How do the individual controllers become visible on the network
- What happens if a controller has to be replaced
- What happens if the gateway has to be replaced

ADAP-KOOL® only

The above communication systems are used for internal communication between ADAP-KOOL® refrigeration control systems. The devices are not designed to communicate with equipment manufactured by other manufacturers.

IP network

In the case of controllers and system units that can be connected to an IP network, installation should be carried out on the basis of the requirements that apply to an IP network, i.e. cables must be category 5.

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A little about controllers and system units

Communication survey

The table below shows which controllers can communicate with which system units and with what form of data communication. The summary is valid as of ultimo 2009, but the system is continually being extended.

System operation	System unit	Controller serie / type	Lon RS485	Lon FTT10	Lon TP 78	MOD BUS	DAN-BUSS	IP
AKM								
	AKA 243A			x			x	
	AKA 245		x				x	
		AKA					x	
		AKC					x	
		AKL					x	
		EKC 201, 301, 3xx, 5xx	x	x				
		EKC 4xx	x					
		EKC 202, 204	x					
		AK-CC, AK-PC	x					
AK-ST 500								
AK-EM 100								
AKM¹⁾								
	AK-SM		x			x		x
		AK-CC, AK-PC	x					
		EKC 201, 301, 3xx, 4xx, 5xx	x					
		EKC 202, 204, AK-CC 210	x			x		
		AK-PI 200					x	
	AK-SC 255		x ²⁾	x ²⁾	x ²⁾	x		x
		AK-CM (communication module) + AK-XM			x			
		AK-CC 303A (TP 78 version)			x			
		EKC 202, 204, 4xx, 5xx, AK-CC, AK-PC	x					
	AK-CS		x			x		

1) AKM can receive alarms and logs from an AK2-SM. The connection is made via an analogue modem, a GPS modem or an IP network.

2) AK-SC is available in several versions:
 - One with Lon-RS485 communication
 - One with Lon FTT communication.
 - One with Lon TP 78 communication.

Controllers with IP communication

Many controllers in the EKC 500 series can be equipped with an IP data communication module. This form of communication can currently **not** be used between controllers and the above system devices with an IP network.

System units

A brief summary is presented here of the communication options for the various system devices:

Gateway type AKA 245

This system device is equipped with DANBUSS data communication and Lon RS485 data communication. It can control the communication of up to 120 controllers. The controllers can be distributed between Lon and DANBUSS by setting a continuous Lon address range of up to 119 addresses.

The system device can create communication for type AKM system software.

The system device can communicate with:

- AKC controllers
- EKC controllers with a Lon RS 485 communication
- AK-CC, AK-PC controllers

Gateway type AKA 243A

This system device is equipped with DANBUSS data communication and Lon FTT10 data communication. It can control the communication of up to 60 controllers on DANBUSS and up to 60 controllers on Lon FTT10.

The system device can create communication for type AKM system software.

The system device can communicate with:

- AKC controllers
- EKC controllers with a Lon FTT10 communication.

m2

This device can record readings from up to 99 devices. A device could for example be a directly mounted temperature sensor or an external device with a temperature sensor, where the readings are sent to m2 via data communication.

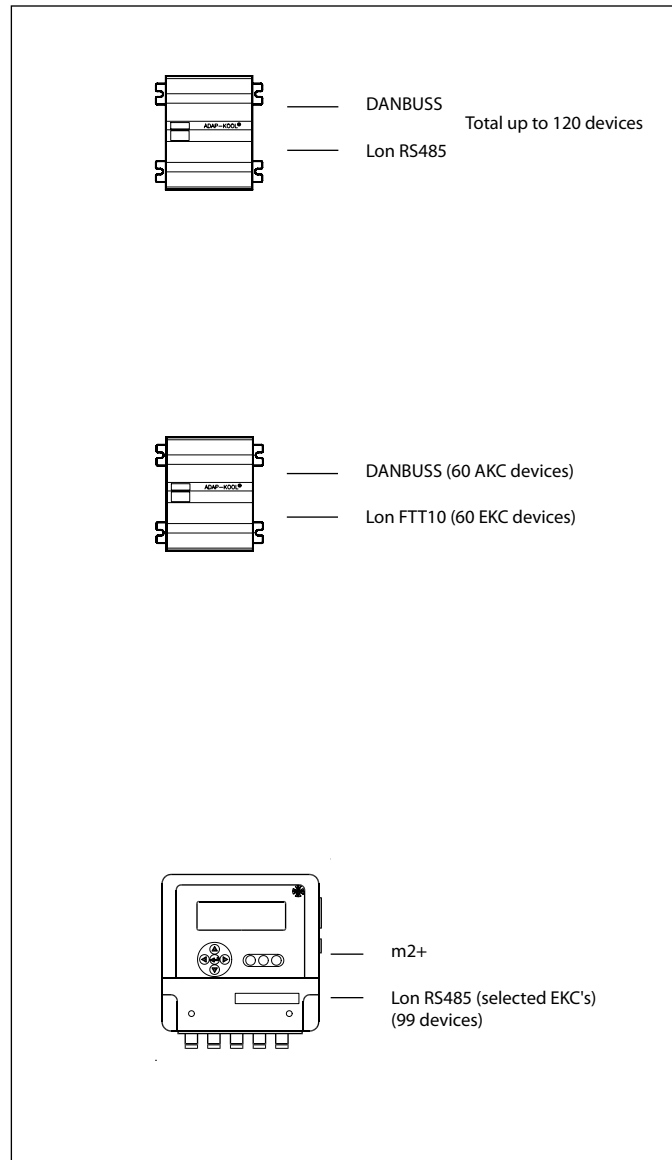
There are two forms of data communication:

RS485 for communication between m2 and m2+ devices.

Lon RS485 for communication between m2 and EKC devices. Only specified EKC devices can communicate with m2.

m2 can communicate with:

- m2+ devices
- EKC controllers (selected controllers only) with Lon RS 485 communication.



AK-SM 720

This system device can record up to 200 devices.

There are three forms of data communication:

- A Lon RS485 bus, to which up to 199 devices can be connected.
- An MOD-bus, to which up to 100 devices can be connected.
- Ethernet communication for other AK-SM devices, to which up to 199 addresses can be connected.

The system device can communicate with:

- AK-CC, AK-PC controllers
- EKC controllers with a Lon RS485 communication
- EKC controllers with a MOD-bus communication
- AK-PI 200 protocol interface with DANBUSS communication
- Other AK-SM devices

AK-SC 255

AK-SC 255 is available in 3 Lon versions:

- With Lon TP78 communication
- With Lon RS485 communication (Note: special order only)
- With Lon FTT communication (Note: special order only)

All 3 has:

- MODBUS communication
- IP communication

It interface to:

AK-CM (Which also comes in all 3 Lon versions)+ AK XM

For EKC / AK (All versions of communication is supported: RS485, Modbus, TP78, IP).

AK-SM 350

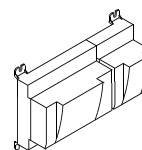
This device can record readings from up to 65 devices. A device could for example be a directly mounted temperature sensor or an external device with a temperature sensor, where the readings are sent to the AK-SM 350 via data communication.

There are four forms of data communication:

- A Lon RS485
- A MOD-bus
- RS485 TP to which m2+ devices or type GD gas detectors can be connected
- A Ethernet communication to other AK-SM 720 or AK-SC devices.

AK-SM 350 can communicate with:

- EKC controllers with Lon RS 485 communication
- EKC controllers with MOD-bus communication
- AK-CC, AK-PC controllers
- m2+ extension modules
- Gas detection sensor type GD
- Other AK-SM 720 devices
- Other AK-SC devices



Lon RS485 (max. 199 devices)

MOD-bus (max. 100 devices)

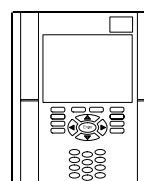
Total on bus: Lon RS 485 + MOD-bus:
max. 199 devices

IP network (max. 199 addresses)

Total AK-SM 720 + AK-PI 200 + IP + bus: max. 200
devices

*A repeater must be added if there are more than 120
devices on the Lon RS485 communication.*

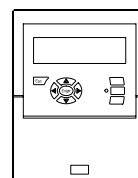
*A repeater must be added if there are more than 32 devices
on the MOD-bus communication.*



Lon RS485

TP 78

P network



Lon RS485

MOD-bus

RS 485 TP

IP network

Total up to
65 devices

Addressing of controllers in the network

On DANBUSS, the addresses must be set before the power is switched on.

For the other communication forms, the address is set after the power has been switched on.

The system device will then know that they are ready on the network.

1. Set the address in the respective controllers
If you should inadvertently give two or more controllers the same address, only the first controller will be visible from the system device.
2. The system device must know the controllers.
The following will occur depending on the communication type:

DANBUSS

On DANBUSS the system device will find the controllers on the network itself.

Lon RS485, Lon FTT10

Here, the controller can send a service PIN to the system device. Or better: The system device can scan the network and find all connected controllers. This scan function must be started manually in the system device.

MOD-bus

Here, the system device must scan the network. The service PIN function on each controller cannot send the address to the system device.

Replacement of controllers in the network

Settings

The system operation includes functions to copy a controller's settings. This function can be used where a controller is to be replaced with the same software version. After swapping, the settings are copied back onto the controller.

Address

Remember to reset the address of the controller with the same address and get the controller to notify the system device again. (You should also do this yourself if you are retaining the existing LON module).

DANBUSS

On DANBUSS the system device will find the controllers on the network itself.

MOD-bus

The system device will scan the network and find the controllers that have been replaced. This scan function must be started manually in the system device.

Lon RS485, Lon FTT10

Here, the controller will send a service PIN to the system device. The scan function in the gateway should not be used, as all alarm priorities (the importance of an alarm) in all connected EKC controllers will be deleted and returned to their factory settings.

Controllers on AK-SM 350

If there is a controller with a more recent software version, AK-SM 350 must also be given a profile of this controller. A file with this profile can be obtained from Danfoss and must be copied onto AK-SM 350.

Replacement of system units in the network

If you replace the system device, the system device's address must be set and the controller addresses must then be uploaded on to the system device.

Gateway type AKA 243 - 245

Set the system address using the AKA 21 operating device. On the DANBUSS communication, the Gateway will find the controllers itself.

On Lon RS485 and Lon FTT10, the scan function can be activated from the AKA 21 operating module. This function is called "Press Enter to scan LON bus".

NB! When the scan function is used, all alarm priorities in **all** connected EKC controllers will be deleted and returned to their factory settings.

AK-SM

On an AK system manager, the address must be set and the service PIN function must be activated.

The scan function can then be started to find all connected controllers.

AK-SC 255

Set the address to the same value as on the previous system device. Then start the Rescan function.

AK-SM 350

No address needs to be set on AK-SM 350.

Start the scan function to find all connected controllers. This function scans all three communication forms at once.

Requirement to installation

Cable type

Cables **twisted in pairs must** be used, and they may be provided with a screen.

Some types of communication **require** a cable **with** a screen to be used.

The conductor's cross section must be at least 0.60 mm.

Examples of cable types:

- Belden 7701NH, single-thread 1 x 2 x 0.65 mm, without screen
- Belden 7702NH, single-thread 2 x 2 x 0.65 mm, without screen
- Belden 7703NH, single-thread 1 x 2 x 0.65 mm, with screen
- Belden 7704NH, single-thread 2 x 2 x 0.65 mm, with screen
- LAPP UNITRONIC Li2YCY (TP), multi-thread 2 x 2 x 0.65 mm, with screen
- Dätwyler Uninet 3002 4P, single-thread 4 x 2 x 0.6 mm, with screen

Conductors

The wires in the cable that is connected to the controller must be correct. Although there are four wires in the cable inside the screen, you cannot simply choose colours freely. The wires are twisted in pairs, i.e. 2 and 2, and you must use a pair that is twisted **around each other**.

If there are several "vacant" wires in the cable, they must be used for nothing else than data communication.

Cable length

A cable length must not exceed 1200m (500m for Lon-FTT10.) A repeater must be used for longer lengths.

See the additional requirements for the respective communication forms.

Important!

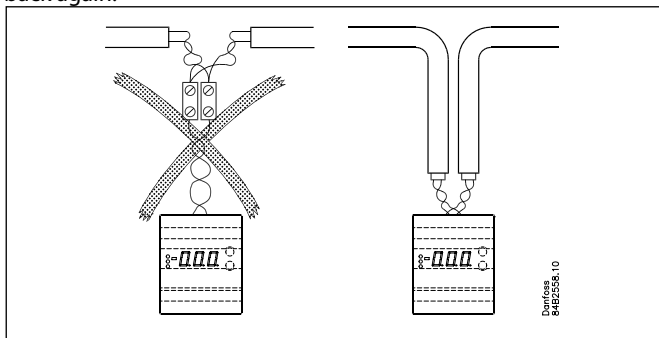
Our experience indicates that problems can occur with communication due to the following weaknesses:

Long wire ends

Do not strip more of the cable insulation than strictly necessary. Max. 3-4 cm. Continue the twisting of the cables right up to the terminals.

Stubs

Avoid stubs on the cable. Feed the cable right to the end and then back again.



Noise sources

Keep the cable away from electrical noise sources and power cables (relays, contactors and **especially** electronic ballast for strip lights are strong noise sources). A distance of at least 10-15 cm will be sufficient.

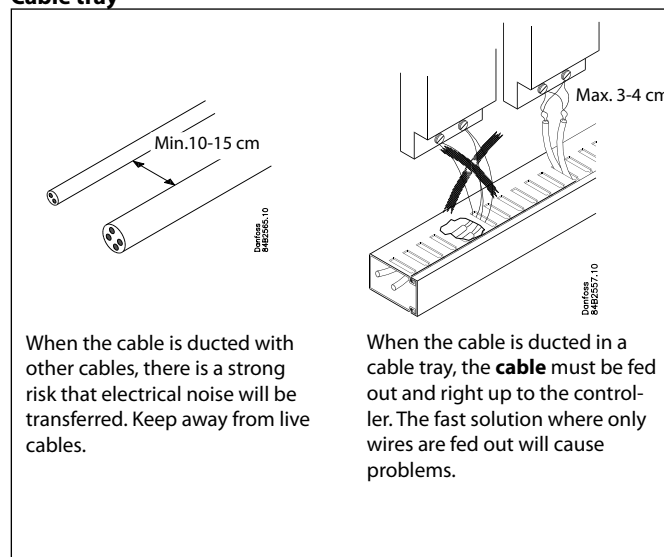
Cable length extremities

Each section of data communication must be terminated correctly. See the relevant communication form on the following pages.

Screen

See the respective communication forms.

Cable tray

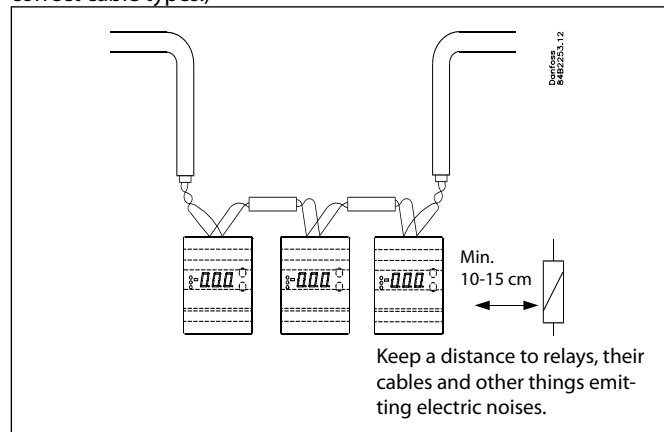


When the cable is ducted with other cables, there is a strong risk that electrical noise will be transferred. Keep away from live cables.

When the cable is ducted in a cable tray, the **cabl**e must be fed out and right up to the controller. The fast solution where only wires are fed out will cause problems.

Cabinet mounting

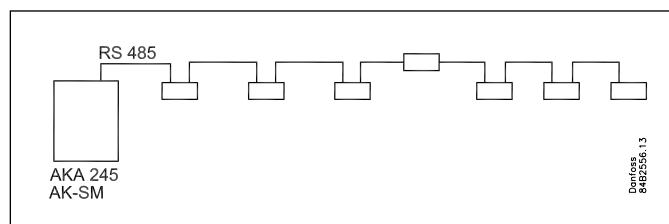
When controllers are installed in a cabinet, internal cable ducting must also comply with the relevant requirements. Use this cable ducting when one or more controllers are installed in a cabinet. (The short connections between controllers must also be of the correct cable types.)



Keep a distance to relays, their cables and other things emitting electric noises.

Lon RS 485 - bus

See also page 7.



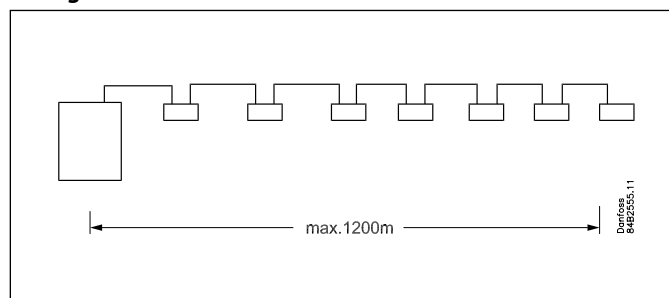
This data communication is primarily used in controllers in the series:

- EKC..
- AK-CC, AK-PC...

The system devices must be:

- Gateway type AKA 245
- System manager from the serie AK-SM
- Monitoring device type AK-SM 350

Wiring



The cable is connected from controller to controller, and **no** branches are allowed on the cable.

If the cable length exceeds 1200 m a repeater must be inserted

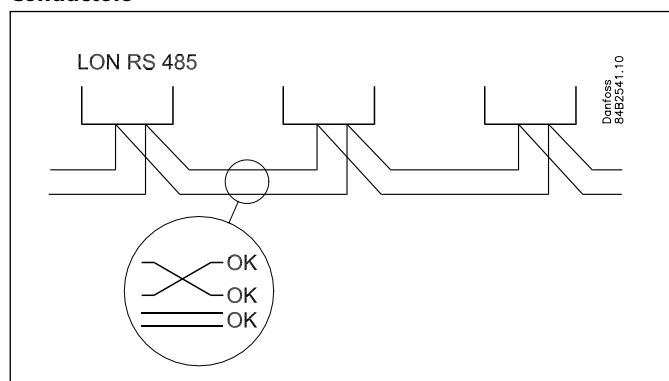
If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilise the signal.

See page 18 for more information on repeaters.

Number of controllers

The total number of controllers on an LON RS485 connection is determined by the system device and can vary between 60 and 119. See the summary of system options on page 4.

Conductors



The two wires are looped from device to device. There are no polarisation requirements.

(On some controllers, the clamps are designated A and B. On others there is no designation. Otherwise the connections are identical.)

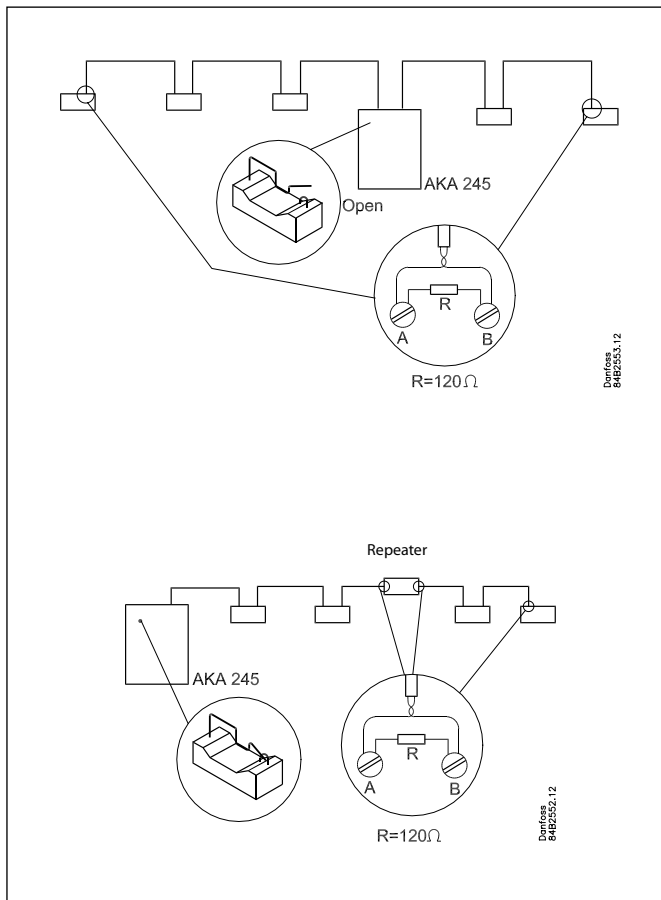
If a screen is used, it must be connected to the system device and any repeaters.

A screen **must always be looped** from device to device.

The screen must **not** be connected to anything else.

(The screen is earthed inside the screen and must not be earthed in any other way.)

Cable sections/termination



When all cables have been mounted on the different units, the cable must be terminated.

A section **must** be terminated at both ends. The section must be terminated using either an external resistor or a contact. Please see the relevant device.

A repeater will normally terminate two cable sections.

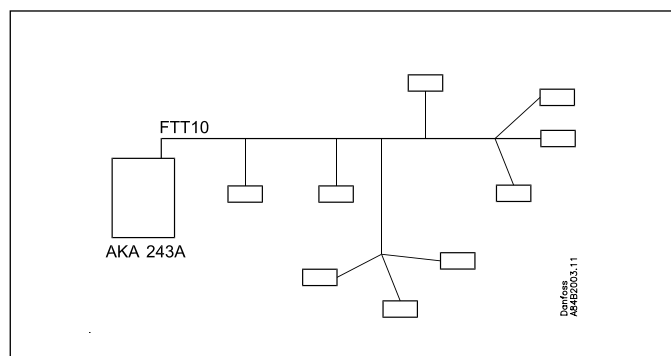
The termination should be made with a 120-ohm resistor. (The resistor can be in the range 100 to 130 ohms.)

If the system device is a gateway, this can be achieved by short-circuiting the bow contact next to the clamp. (The bow contact on a gateway is terminated with 120 ohms.)

Type EKC 414 and EKC 513 controllers are also fitted with bow contacts for termination. A closed bow gives termination.

Lon FTT 10 - bus

See also page 7.

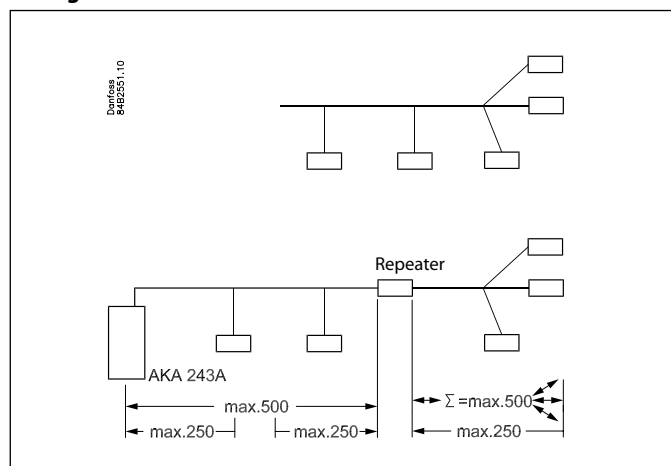


This data communication can be used in the series:

- EKC 201, 301, 3xx and 5xx

The system device must be a gateway type AKA 243A.

Wiring



The wiring is optional, and branches are allowed on the cable.

For each 500 m cable the signal must be repeated.

- If the sum of cable lengths on a subsection is more than 500 m the signal must be repeated.

There must be max. 250 m from a controller to a gateway or from a controller to a repeater.

If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilise the signal.

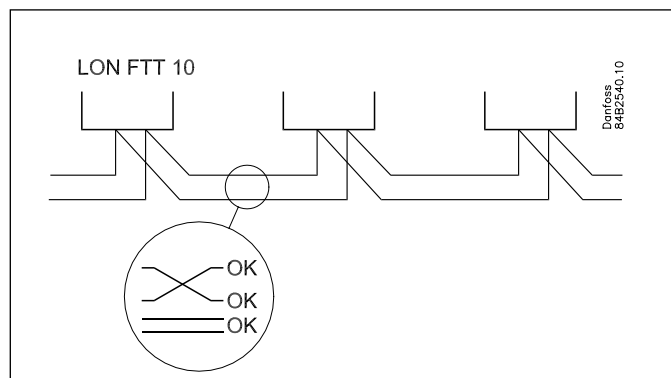
See page 18 for more information on repeaters.

Number of controllers

The total number of controllers on an Lon FTT10 connection is determined by the address options on the system device.

On AKA 243A is it 60 units.

Conductors



The two wires are looped from device to device. There are no polarisation requirements.

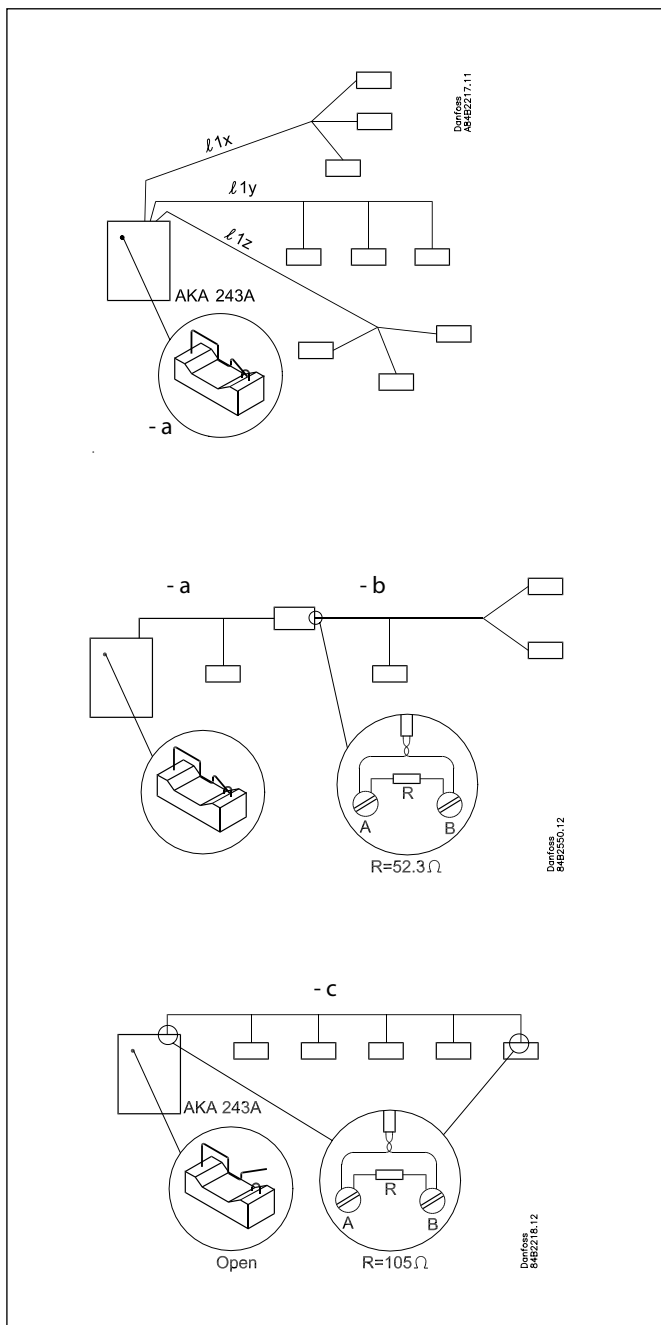
If a screen is used, it **must** be connected to the gateway and any repeaters.

A screen **must always be looped** from device to device.

The screen **must not** be connected to anything else.

(The screen is earthed inside the screen and must not be earthed in any other way.)

Cable sections / termination



When all cables have been mounted on the different devices, the cable sections must be terminated. Short sections are only terminated at one end. Long sections, as shown on the bottom drawing, must be terminated at both ends. The section must be terminated either using an external resistor or a contact. Please see the relevant device.

- a
On the first section connected to the gateway this can be accomplished by shortcircuiting the bracket switch located at the terminal. This only applies if none of the individual star connections exceed 250 m. (The bow contact of an AKA 243A terminates with 52.3 ohm).

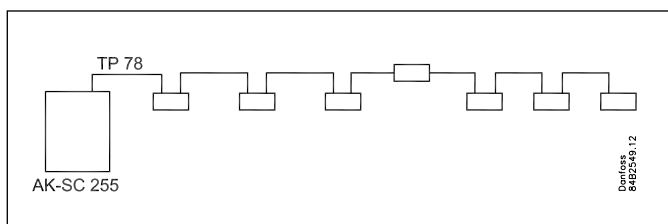
- b
If repeaters have been used, the succeeding section must also be terminated. This is done by mounting a resistance over the cable's wires. The resistance can be mounted anywhere on the cable. Note the resistance value.

(It is acceptable that the resistance on the 52.3 ohm is in the order of between 50 and 60 ohm).

- c
If a cable section exceeds 250 m, the termination must be in the shape of a double termination, i.e. resistances at both ends of this section. Any other star sections are not to be terminated. Note the size of the resistances. The integrated termination with the bow contact must **not** be used in this case. The bow contact must be opened and an external resistor must be fitted.

Lon TP 78 - bus

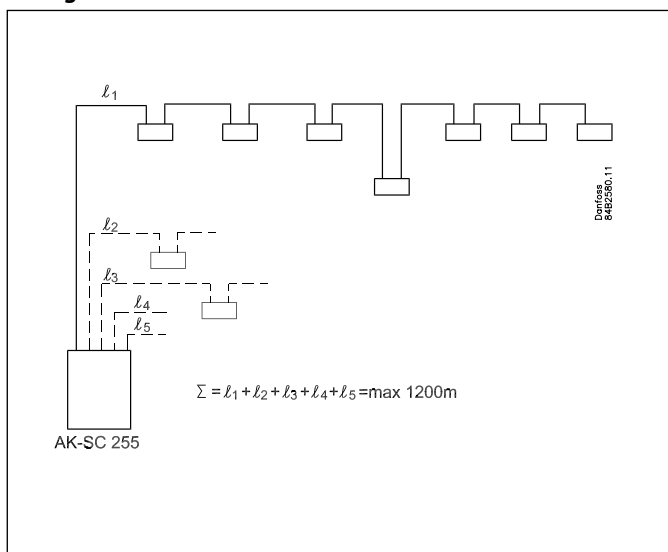
See also page 7.



This data communication is used between the following devices:

- System controller type AK-SC 255 and
- AK-CM - communication modules
- AK-CC - Case control (TP 78 version)

Wiring



Cables with screen must be used.

The cable is connected from controller to controller, and **no** branches are allowed on the cable.

A cable section must not be longer than 1200m.
A repeater must be used for longer sections.

The sum of all sections must not exceed 1200m.
A repeater must be used if the sum is greater.

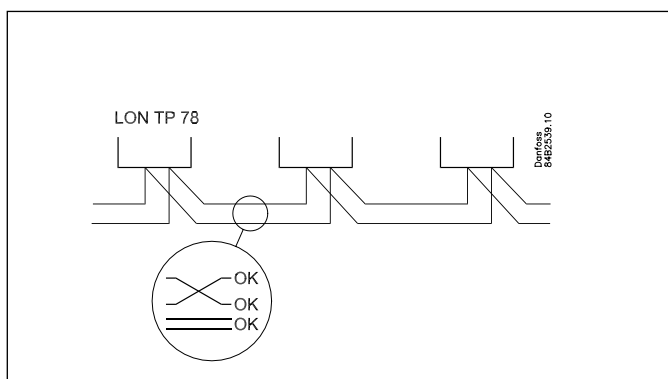
If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilise the signal.

See page 18 for more information on repeaters.

Number of controllers

The total number of controllers on a TP 78 connection is determined by the controlling unit and can be up to 120. See the summary of system options on page 4.

Conductors

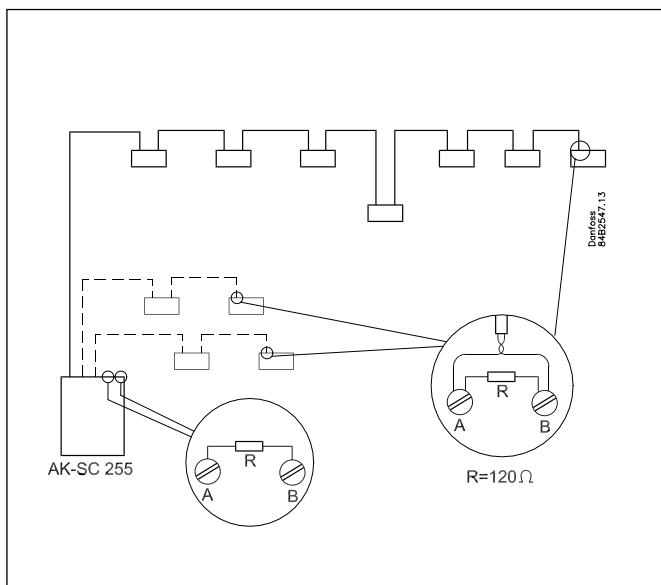


The two wires are looped from device to device. There are no polarisation requirements.

The screen **must** be connected to the AK-SC255 and any repeaters.
A screen **must always be looped** from device to device.

The screen must **not** be connected to anything else.
(The screen is earthed inside the device and must not be earthed in any other way.)

Cable sections / termination



When all cables have been mounted on the different devices, the cable must be terminated.

A section **must** be terminated at the end of each of the five sections from the system device.

Termination is performed with the resistors (terminations) supplied.

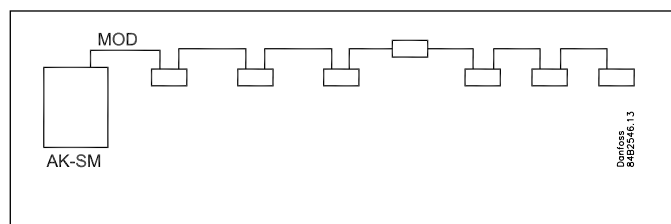
If one or more of the five connections is not used, the termination on the clamp row should be retained.

A repeater will always terminate two cable sections.

A section after a repeater must be terminated at both ends.

MOD - bus

See also page 7.



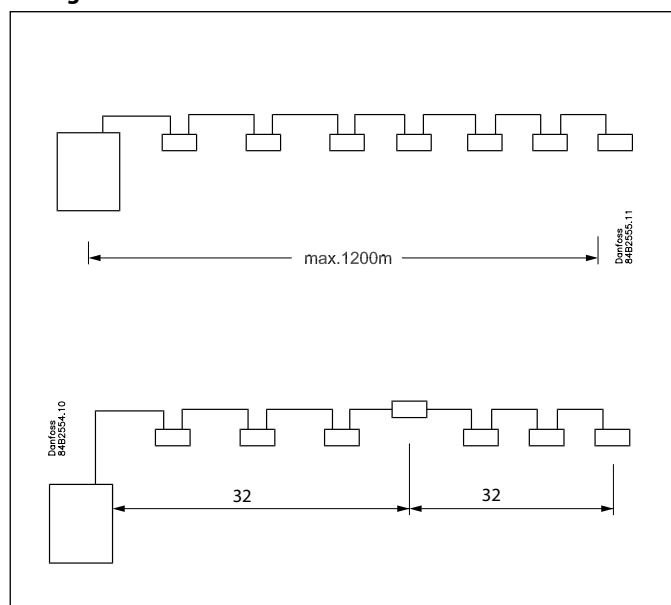
This data communication can be used in the serie:

- EKC..

The system device must be:

- System manager type AK-SM
- Monitoring unit type AK-SM 350

Wiring



The cable must be with screen.

The cable is connected from controller to controller, and **no** branches are allowed on the cable.

If the cable length exceeds 1200 m a repeater must be inserted

One repeater must be added for every 32 controllers.

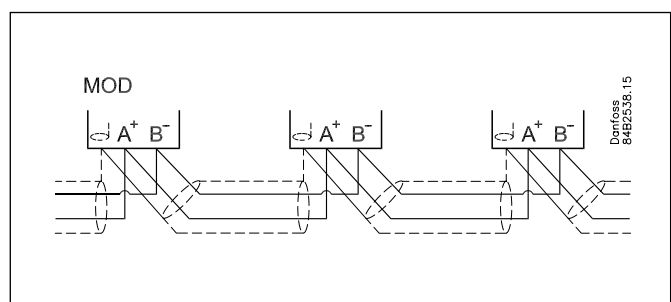
If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilise the signal.

See page 18 for more information on repeaters.

Number of controllers

The total number of controllers on an MOD bus connection can be 100. See the summary of system options on page 4.

Conductors



The wires are looped from device to device.

A is connected to A

B is connected to B.

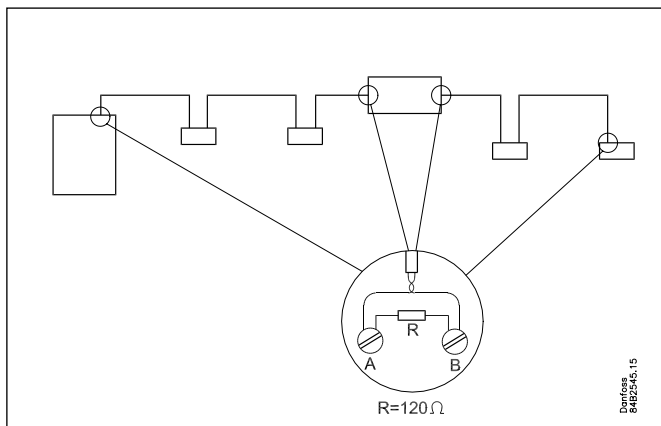
The screen **must** be connected to the system device, all controllers and any repeaters.

A screen **must always be looped** from device to device.

The screen must not be connected to anything else.

(The screen is earthed inside the system device and must not be earthed in any other way.)

Cable sections / termination



When all cables have been mounted on the different devices, the cable must be terminated.

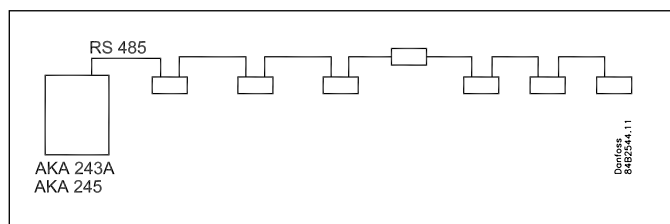
A section **must** be terminated at both ends. The section must be terminated using either an external resistor or a contact. Please see the relevant device.

A repeater will always terminate two cable sections.

The termination should be made with a 120-ohm resistor. (The resistor can be in the range 100 to 130 ohms.)

DANBUSS

See also page 7.



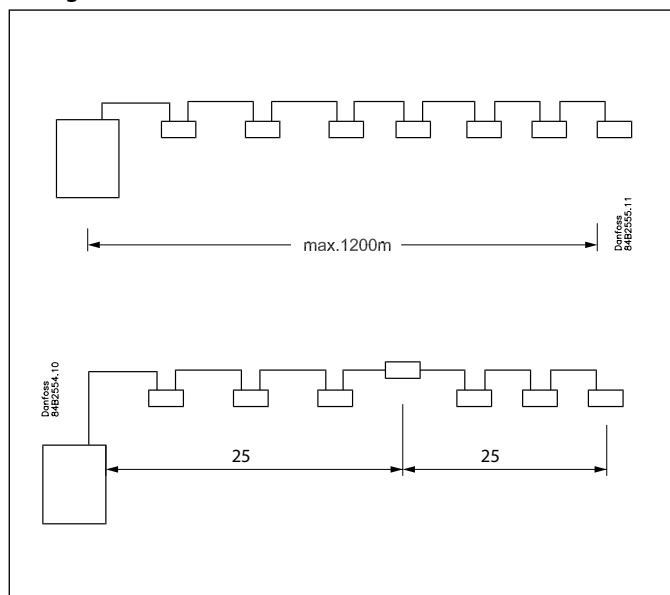
This data communication is used in the serie:

- AKC.

The system device must be a gateway type:

- AKA 243A or
- AKA 245

Wiring



Cable must be with screen.

The cable is connected from controller to controller, and **no** branches are allowed on the cable.

If the cable length exceeds 1200 m a repeater must be inserted.

One repeater must be added for every 25 controllers.

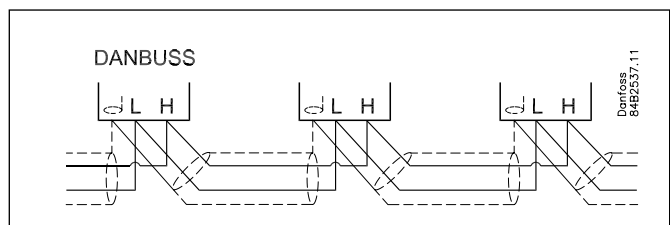
If the data communication cable runs through an electrically noisy environment which impairs the data signal, one or more repeaters must be added to stabilise the signal.

See page 18 for more information on repeaters.

Number of controllers

The total number of controllers on an Danbuss connection is determined by the controlling device and can vary between 60 and 120. See the summary of system options on page 4.

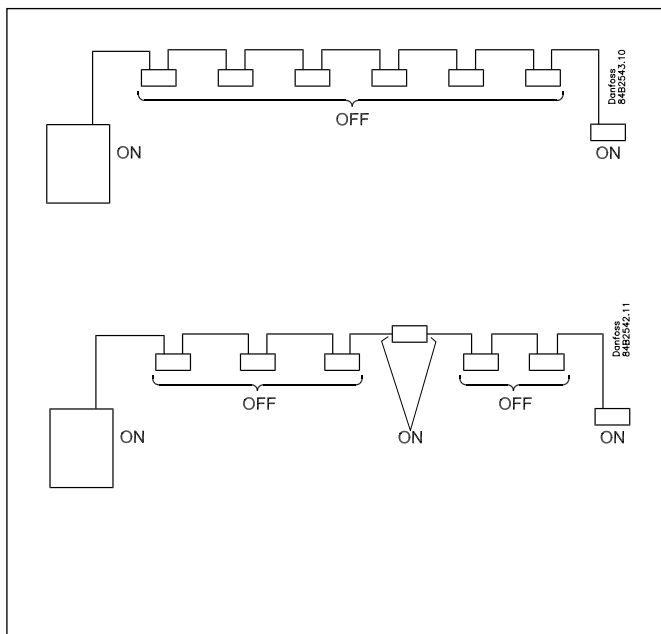
Conductors



The wires are looped from device to device. L (K3) is connected to L (K3) and H (K4) to H (K4).

The screen must be connected to screen (k1) on all controllers and any repeaters. The screen must **not** be connected to anything else. (The screen is earthed inside the system device and must not be earthed in any other way.)

Cable sections / termination



When all cables have been mounted on the different units, the cable must be terminated.

The termination is made using changeover switches and bow contacts.

A section **must** be terminated at both ends. Setting = ON. Other settings must be OFF.

A repeater which forms the end of two cable sections is shown here.

Termination is performed using bow contacts or resistors on either side of the repeater. Loose resistors must be 120 ohms.

Further information:
Installation guide RCOXA

Combinations of net

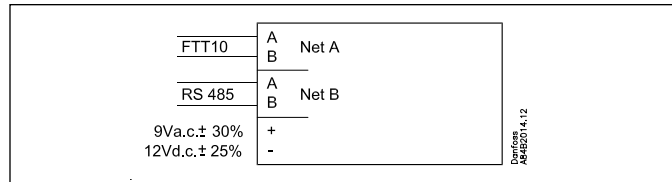
Bridge

A bridge has no address.

Lon FTT 10 to Lon RS 485 and reverse

A bridge type **TP78-05** can be used.

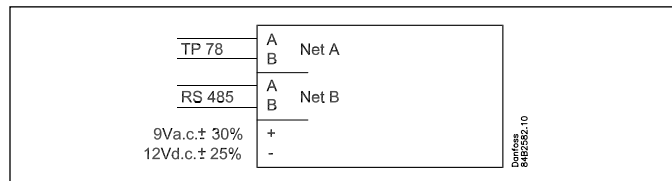
Code no. = 084B2255.



Lon TP 78 to Lon RS 485 and reverse

A bridge type **TP78-04** can be used.

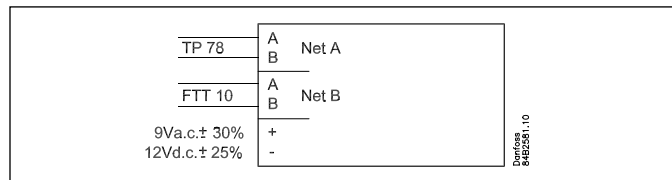
Code no. = 084B2254.



Lon TP 78 to Lon FTT10 and reverse

A bridge type **TP78-02** can be used.

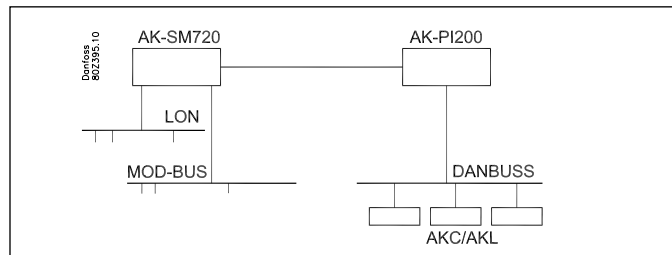
Code no. = 084B2252.



DANBUSS to AK-SM 720

Protocol interface **AK-PI 200** can be used.

Literature no. = RS8EX.



Repeater

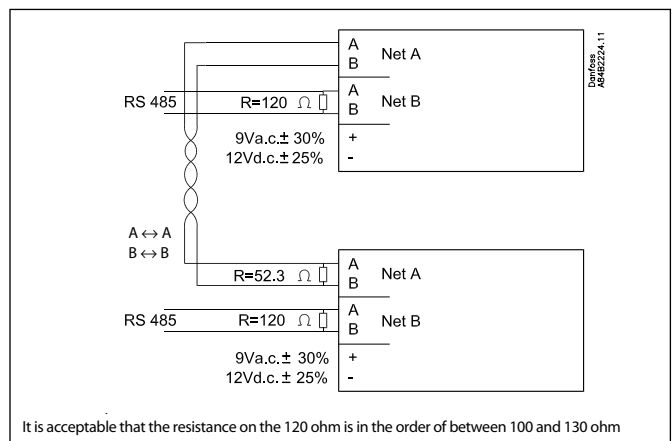
A repeater has no address.

Lon RS 485

- A repeater from the company "Phoenix" can be used:
Danfoss code no = 084B2241 (type AKA 223)

Here has the communication speed to be set to 78.1 kbps.

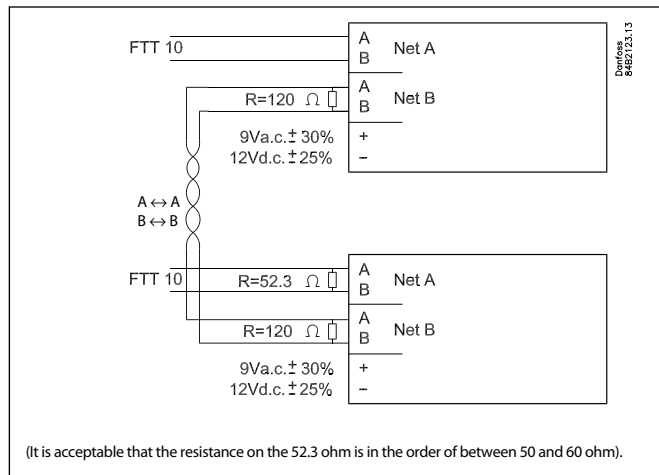
- A repeater for LON 485 can be generated by two bridges.
Use 2 units of 084B2255.



Lon FTT 10

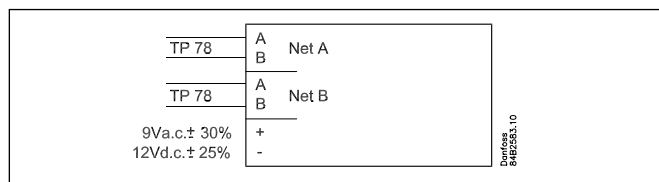
• A repeater from the company "Gesyttec" can be used:
Gesyttec FTT10 lon-repeater.

• A repeater for FTT 10 can be generated by two bridges.
Use 2 units of 084B2255.



Lon TP 78

A repeater type **TP78-01** can be used.



MOD-bus

A repeater from the company "Phoenix" can be used:
Danfoss code no. = 084B2240 (type AKA 222).

Here has the communication speed to be set to 19.2 kbps.

DANBUSS

A repeater from the company "Phoenix" can be used:
Danfoss code no. = 084B2240 (type AKA 222).

Here has the communication speed to be set to 4.8 kbps.

(Repeater type AKA 22 is discontinued.)

A on the repeater must be connected to DANBUSS-terminal L.
B on the repeater must be connected to DANBUSS-terminal H.



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