



Installation Guide

VLT[®] DeviceNet MCA 104

VLT[®] Frequency Converter Series FC 102 • FC 202 • FC 301 • FC 302



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1 Introduction

1.1 Purpose of the Manual

This installation guide provides information for quick installation of a VLT® DeviceNet MCA 104 interface in the VLT® frequency converter.

The installation guide is intended for use by qualified personnel. Users are assumed to be familiar with the VLT® frequency converter, with DeviceNet technology, and with the PC or PLC that is used as a master in the system. Read the instructions before installation and ensure that instructions for safe installation are observed.

VLT® is a registered trademark.

1.2 Additional Resources

Resources available for the frequency converters and optional equipment:

- The *VLT® Operating Instructions* provide the necessary information for getting the frequency converter up and running.
- The *VLT® Design Guide* provides detailed information about capabilities and functionality to design motor control systems.
- The *VLT® Programming Guide* provides greater detail on working with parameters and many application examples.
- The *VLT® DeviceNet MCA 104 Installation Guide* provides information about installing the DeviceNet and troubleshooting.
- The *VLT® DeviceNet MCA 104 Programming Guide* provides information about configuring the system, controlling the frequency converter, parameter access, programming, troubleshooting, as well as some typical application examples.

Supplementary publications and manuals are available from Danfoss. See www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/VLT+Technical+Documentation.htm for listings.

1.3 Product Overview

1.3.1 Intended Use

This installation guide relates to the DeviceNet interface. Ordering number:

- 130B1102 (non coated version)
- 130B1202 (conformal coated version)

DeviceNet is a low-level network that standardises communications between industrial devices (sensors, limit switches, motor controls) and high-level devices (controllers). DeviceNet systems can be configured to operate in a master-follower or a distributed control architecture using peer-to-peer communication. The DeviceNet interface is designed to communicate with any master abiding by the DeviceNet standard.

VLT® DeviceNet MCA 104 is intended for use with:

- VLT® HVAC Drive FC 102
- VLT® AQUA Drive FC 202
- VLT® AutomationDrive FC 301
- VLT® AutomationDrive FC 302

1.3.2 Items Supplied

When the fieldbus option is not factory mounted, the following items are supplied:

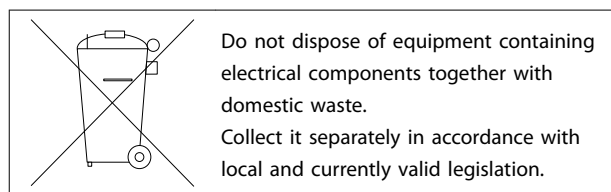
- Fieldbus option and connector
- LCP cradle
- Front covers (in various sizes)
- Stickers
- Accessories bag (including EMC bracket)
- Installation Guide

1.4 Approvals and Certifications



More approvals and certifications are available. For more information, contact a Danfoss local partner.

1.5 Disposal



1.6 Symbols, Abbreviations and Conventions

Abbreviation	Definition
ACK	Acknowledge
BOC	Bus off counter
BOOL	Boolean expression
CAN	Controller area network
CSMA/CA	Carrier sense multiple access/collision avoidance
COS	Change of state
CTW	Control word
EDS	Electronic data sheet
EMC	Electromagnetic compatibility
ETR	Electronic thermal relay
FIFO	First In first out
HF	High frequency
HPFB	High performance field bus
I/O	Input/output
ISO	International standards organization
LCD	Liquid crystal display
LED	Light emitting diode
LSB	Least significant bit
MAC ID	Media access control identifier
MAV	Main actual value
MRV	Main reference value
MSB	Most significant bit
N/A	Not applicable
ODVA	Open deviceNet vendor association
OSI	Open systems interconnection
PC	Personal computer
PCD	Process data
PIW	Peripheral input word
PLC	Programmable logic control
PNU	Parameter number
PPO	Parameter-process data object
QW	Peripheral output word
SINT	Signed integer
STW	Status word
VSD	Variable speed drive
UDINT	Unsigned double integer
UNIT	Unsigned integer
USINT	Unsigned short integer

Table 1.1 Symbols and Abbreviations

Conventions

Numbered lists indicate procedures.

Bullet lists indicate other information and description of illustrations.

Italicised text indicates:

- Cross reference
- Link
- Parameter name

2 Safety

2.1 Safety Symbols

The following symbols are used in this manual:

⚠ WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install or operate this equipment.

Qualified personnel are defined as trained staff, who are authorised to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Additionally, the qualified personnel must be familiar with the instructions and safety measures described in these operating instructions.

2.3 Safety Precautions

⚠ WARNING

HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- Installation, start-up, and maintenance must be performed by qualified personnel only.

⚠ WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start with an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 Set-up Software, or after a cleared fault condition.

To prevent unintended motor start:

- Disconnect the frequency converter from the mains.
- Press [Off/Reset] on the LCP before programming parameters.
- The frequency converter, motor, and any driven equipment must be fully wired and assembled when the frequency converter is connected to AC mains, DC supply, or load sharing.

⚠ WARNING

DISCHARGE TIME

The frequency converter contains DC-link capacitors that can remain charged even when the frequency converter is not powered. Failure to wait the specified time after power has been removed before performing service or repair work, can result in death or serious injury.

- Stop the motor.
- Disconnect the AC mains and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.
- Disconnect or lock the PM motor.
- Wait for the capacitors to discharge fully before performing any service or repair work. The duration of waiting time is specified in the relevant frequency converter operating instructions, *Chapter 2 Safety*.

⚠ WARNING

LEAKAGE CURRENT HAZARD

Leakage currents exceed 3.5 mA. Failure to ground the frequency converter properly can result in death or serious injury.

- Ensure the correct grounding of the equipment by a certified electrical installer.

⚠ WARNING**EQUIPMENT HAZARD**

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- Ensure that only trained and qualified personnel perform installation, start-up, and maintenance.
- Ensure that electrical work conforms to national and local electrical codes.
- Follow the procedures in this manual.

⚠ CAUTION**INTERNAL FAILURE HAZARD**

An internal failure in the frequency converter can result in serious injury, when the frequency converter is not properly closed.

- Ensure that all safety covers are in place and securely fastened before applying power.

3 Installation

3

3.1 Safety Instructions

See *chapter 2 Safety* for general safety instructions.

3.2 EMC-compliant Installation

To obtain an EMC-compliant installation, follow the instructions provided in the relevant frequency converter *operating instructions* and *design guide*. Refer to the fieldbus master manual from the PLC supplier for further installation guidelines.

3.3 Grounding

- Ensure that all stations connected to the fieldbus network are connected to the same ground potential. When there are long distances between the stations in a fieldbus network, connect the individual station to the same ground potential. Install equalising cables between the system components.
- Establish a grounding connection with low HF impedance, for example by mounting the frequency converter on a conductive back plate.
- Keep the ground wire connections as short as possible.
- Establish electrical contact between the cable screen and the frequency converter enclosure by using metal cable glands or by using the clamps provided on the equipment.
- Use high-strand wire to reduce electrical interference.

3.4 Cable Routing

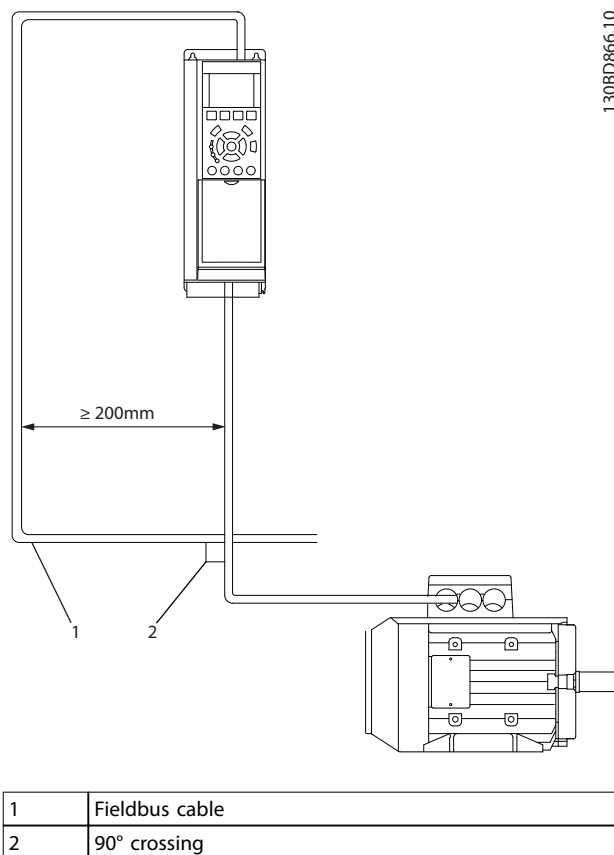
NOTICE

EMC INTERFERENCE

Use screened cables for motor and control wiring, and separate cables for fieldbus communication, motor wiring, and brake resistor. Failure to isolate fieldbus communication, motor, and brake resistor cables can result in unintended behaviour or reduced performance. Minimum 200 mm (7.9 in) clearance between power, motor, and control cables is required. For power sizes above 315 kW, it is recommended to increase the minimum distance of 500 mm (20 in).

NOTICE

When the fieldbus cable crosses a motor cable or a brake resistor cable, ensure that the cables cross at an angle of 90°.

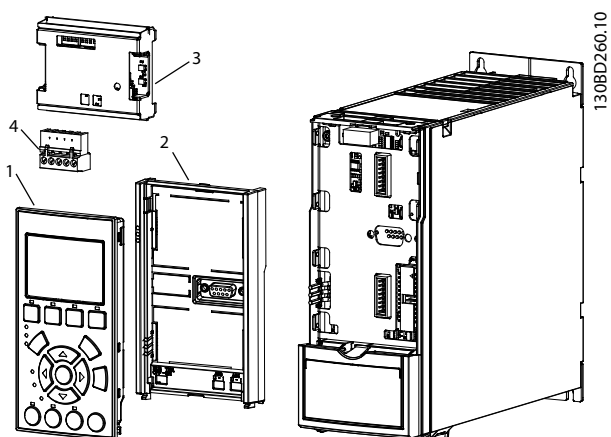


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Illustration 3.1 Cable Routing

3.5 Mounting

1. Check whether the fieldbus option is already mounted in the frequency converter. If already mounted, go to step 6. If not mounted, go to step 2.
2. Remove the LCP or blind cover from the frequency converter.
3. Use a screwdriver to remove the front cover and the LCP cradle.
4. Mount the fieldbus option. Mount the option with the connector facing up for top cable entry (see *Illustration 3.3*), or with the connector facing down for bottom cable entry (see *Illustration 3.4*). If an MCB option is installed, only top cable entry is possible.
5. Remove the knock-out plate from the new LCP cradle.
6. Mount the new LCP cradle.



1	LCP
2	LCP cradle
3	Fieldbus option
4	Connector

Illustration 3.2 Exploded View

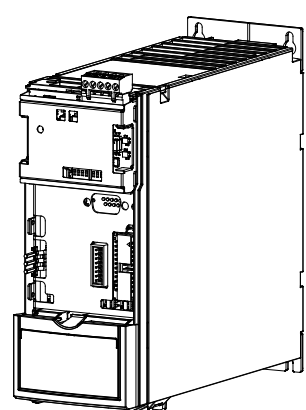


Illustration 3.3 Top Cable Entry: Option Mounted with Connector Facing Up

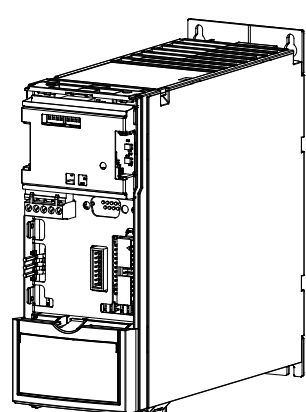


Illustration 3.4 Bottom Cable Entry: Option Mounted with Connector Facing Down

3.6 Setting Address Switches

NOTICE

Switch off the power supply before changing the address switches. The address change comes into effect at the next power-up.

Set the address switches to give the option a unique ID. Select an address range from 0 to 63 (factory setting 63) according to *Table 3.1*.

Switch	8	7	6	5	4	3	2	1
Address value	-	-	+32	+16	+8	+4	+2	+1
5	-	-	OFF	OFF	OFF	ON	OFF	ON
20	-	-	OFF	ON	OFF	ON	OFF	OFF
35	-	-	ON	OFF	OFF	OFF	ON	ON

Table 3.1 Settings for the Address Switches

Alternatively, assign a unique ID from *parameter 10-02 MAC ID*. For setting the address from *parameter 10-02 MAC ID*, ensure that all address switches are set to "ON". When the address is already set using address hardware switches, the address value shown in *parameter 10-02 MAC ID* is 'read only'.

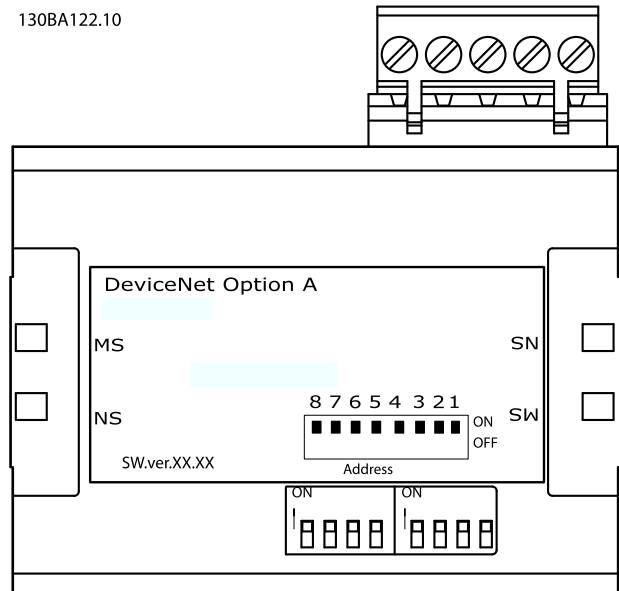


Illustration 3.5 Location and Sequence of the Address Switches

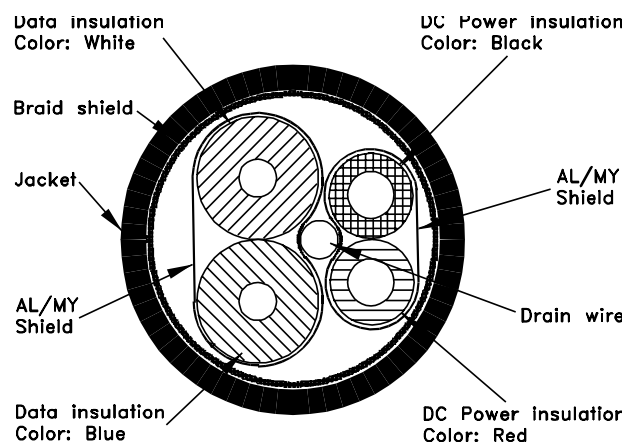
3.7 Electrical Installation

3.7.1 Cable Specifications

Baud rate [kBaud]	Max. total cable length [m]	Drop length	
		Max. per drop [m]	Cumulative max. [m]
125	500	6	156
250	250		78
500	100		39

Table 3.2 Cable Lengths

- Use the cables according to ODVA specifications.
- Note that the ODVA "Flat Cable" is an unshielded cable type, and is not suited for use with frequency converters.



175ZA597.10
Illustration 3.6 ODVA "Thin Cable" Cross-section

3.7.2 Wiring Procedures

Wiring Procedure for Enclosure Types A1-A3

1. Mount the fieldbus connector on the fieldbus option (terminal V-, CAN_L, Drain, CAN_H, V+). For top cable entry, mount the supplied EMC bracket on top of the frequency converter with 2 screws.
2. Prepare the fieldbus cable by stripping a section of the cable insulation, so that the cable screen contacts the EMC bracket. Keep the unshielded wire as short as possible. For cable specifications, refer to *chapter 3.7.1 Cable Specifications*.
3. Connect the fieldbus cable wires to the terminals according to the colour code of the wires, see *Illustration 3.8*.
4. Position the stripped cable between the spring loaded metal clamps, to establish mechanical fixation and electrical contact between cable screen and ground.

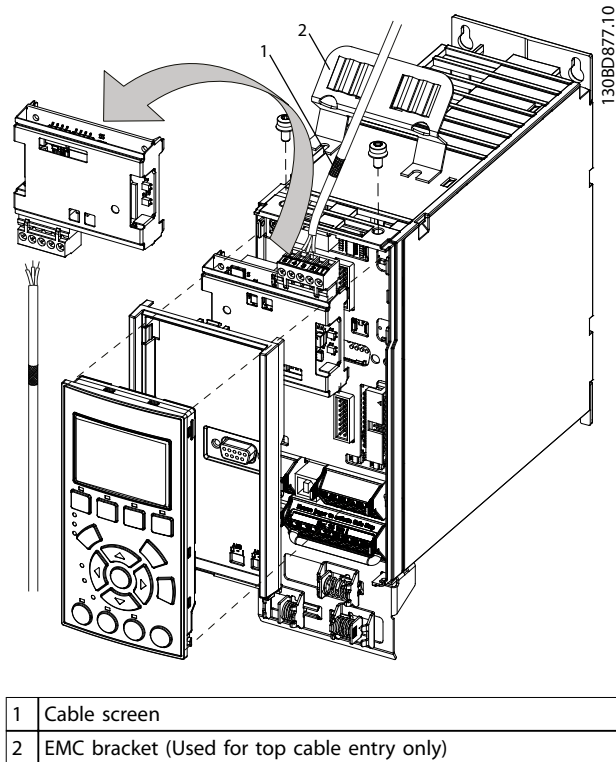
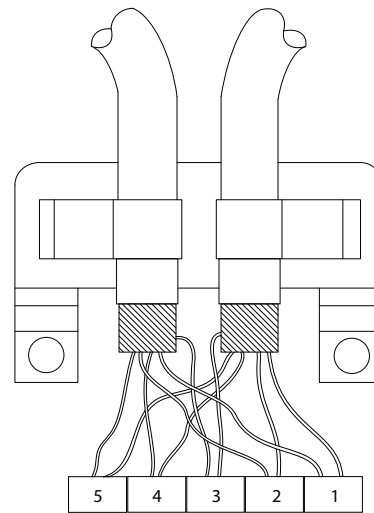


Illustration 3.7 Wiring for Enclosure Types A1-A3

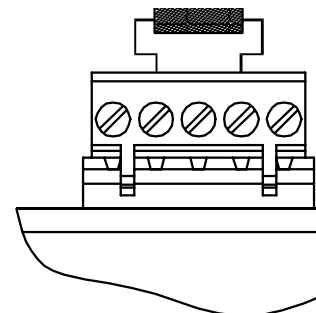


Pin no.	Terminal	Colour	Name
1	V-	Black	GND
2	CAN_L	Blue	CAN LOW
3	Drain	(bare)	Screen
4	CAN_H	White	CAN HIGH
5	V+	Red	+24 V

Illustration 3.8 Fieldbus Cable Terminal Connections

DeviceNet termination

Install the termination resistors at each end of the bus line. Mount the resistor between terminal 2 (CAN_L) and terminal 4 (CAN_H). The resistors have the following specification: 121 Ohm, 1% Metal film, 1/4 Watt



130BA125.10

Illustration 3.9 Termination Resistor Mounted

130BE259.10

Drop cable

An alternative to splicing 2 trunk lines in the connector on the control card is to use a DeviceNet connection box or a T-connector. For this installation, a drop cable is available as an option. Drop cable order number: 195N3113. The connector is a micro-style, male, with rotating coupling nut, and fits into a Micro Device port.

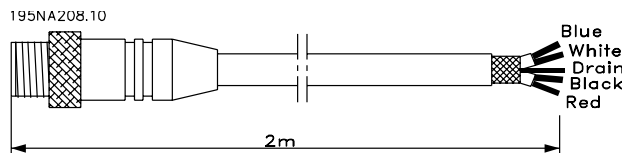


Illustration 3.10 Drop Cable

Wiring Procedure for Enclosure Types A4-A5, B1-B4, and C1-C4

1. Push the cable through cable glands.
2. Mount the fieldbus connector on the fieldbus option (terminal V-, CAN_L, Drain, CAN_H, V+).
3. Prepare the fieldbus cable by stripping a section of the cable insulation. Keep the unshielded wire as short as possible. For cable specifications, refer to *chapter 3.7.1 Cable Specifications*.
4. Connect the fieldbus cable wires to the terminals according to the colour code of the wires, see *Illustration 3.8*.
5. Fix the cable screen to the metal base plate using cable clamp or cable tie, see *Illustration 3.11*.
6. Tighten cable glands securely.

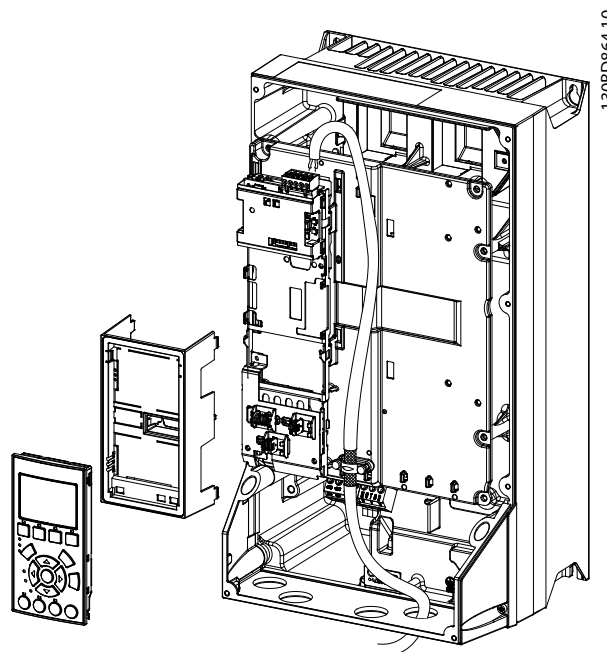


Illustration 3.11 Wiring for Enclosure Types A4-A5, B1-B4, and C1-C4

Wiring Procedure for Enclosure Types D, E, and F

1. Mount the fieldbus connector on the fieldbus option (terminal V-, CAN_L, Drain, CAN_H, V+).
2. Prepare the fieldbus cable by stripping a section of the cable insulation. Keep unshielded wire as short as possible. For cable specifications, refer to *chapter 3.7.1 Cable Specifications*.
3. Connect the fieldbus cable wires to the terminals according to the colour code of the wires, see *Illustration 3.8*.
4. Fix the cable screen to the metal base plate using cable clamp or cable tie, see *Illustration 3.12*.
5. Tie down the cable and route it with other control wires inside the unit, see *Illustration 3.12*.

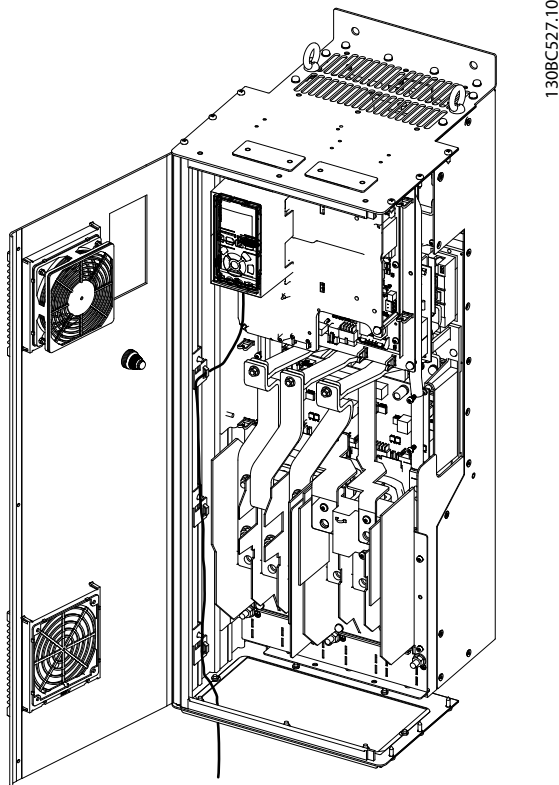


Illustration 3.12 Wiring for Enclosure Types D, E, and F

3.8 Reassembling Cover

1. Mount the new front cover and the LCP.
2. Attach the sticker with the correct product name to the front cover.

3.9 Applying Power

Follow the instructions in the frequency converter *Operating Instructions* to commission the frequency converter. The frequency converter automatically detects the DeviceNet interface. A new parameter group (Group 10-XX) appears.

3.10 Checking Network Cabling

1. If the address has not been set via the address switches, go to *parameter 10-02 MAC ID* to set the address.
2. Connect to a running DeviceNet master.
3. Check that network cabling is correct or not.

4 Troubleshooting

4.1 Warnings and Alarms

NOTICE

Refer to the relevant *Operating Instructions* for an overview of warning and alarm types and for the full list of warnings and alarms.

Alarm word, warning word, and DeviceNet warning word are shown on the frequency converter display in hex format. When there is more than 1 warning or alarm, the sum of all warnings or alarms is shown. Alarm word, warning word, and DeviceNet warning word can also be displayed using the serial bus in *parameter 16-90 Alarm Word*, *parameter 16-92 Warning Word*, and *parameter 16-05 Main Actual Value [%]*.

4

4.2 Troubleshooting

4.2.1 LED Status

The 2 bi-colour LEDs on the DeviceNet card indicate the status of DeviceNet communication:

- The lower LED (NS) indicates the net status.
- The upper LED (MS) indicates the module status.

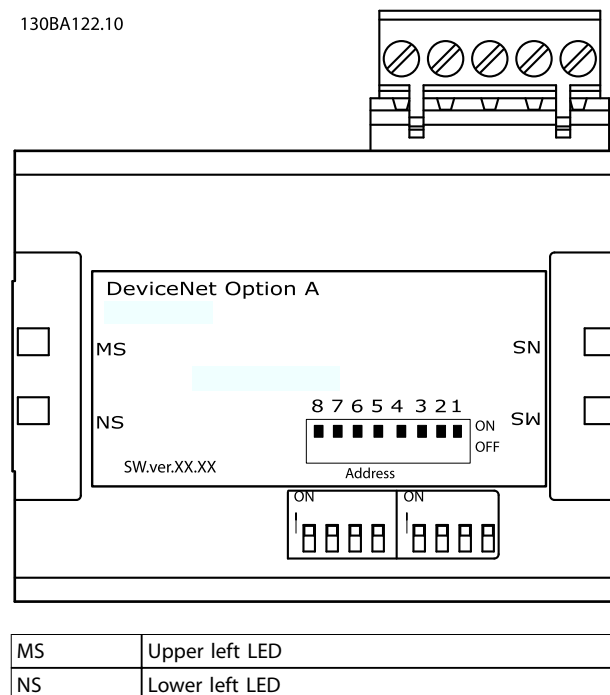


Illustration 4.1 LED Panel DeviceNet MCA 104

State	Bi-colour LED	Status
No Power	Off	There is no power applied to the option.
Device operational	Green	The DeviceNet option is operating in normal condition.
Standby	Green	The DeviceNet option needs commissioning due to configuration missing, incomplete or incorrect.
Minor fault	Red	Recoverable fault.
Unrecoverable fault	Red	Unrecoverable fault, may need replacing.
Self test	Green	The DeviceNet option is in Self-test mode.
	Red	

Table 4.1 LED: Module Status (MS)

State	Bi-colour LED		Status
No Power/Not on-line	Off		The option has not completed "Duplicate MAC ID" test yet or may not be powered.
On-line, not connected	Green		The option is on-line, but not allocated to a master.
On-line and connected	Green		The DeviceNet option is on-line and connected to a master.
Connection time-out	Red		One or more I/O connections are in time-out state.
Critical link failure	Red		

Table 4.2 LED: Network Status (NS)

4.2.2 No Communication with the Frequency Converter

When there is no communication with the frequency converter, proceed with the following checks:

1. Check that cabling is correct.
Check that the cables are connected to the correct terminals as shown in *Illustration 3.8*.
2. Check that the bus connection is terminated at both ends.
If not, terminate the bus connection with termination resistors at the initial and final nodes.

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