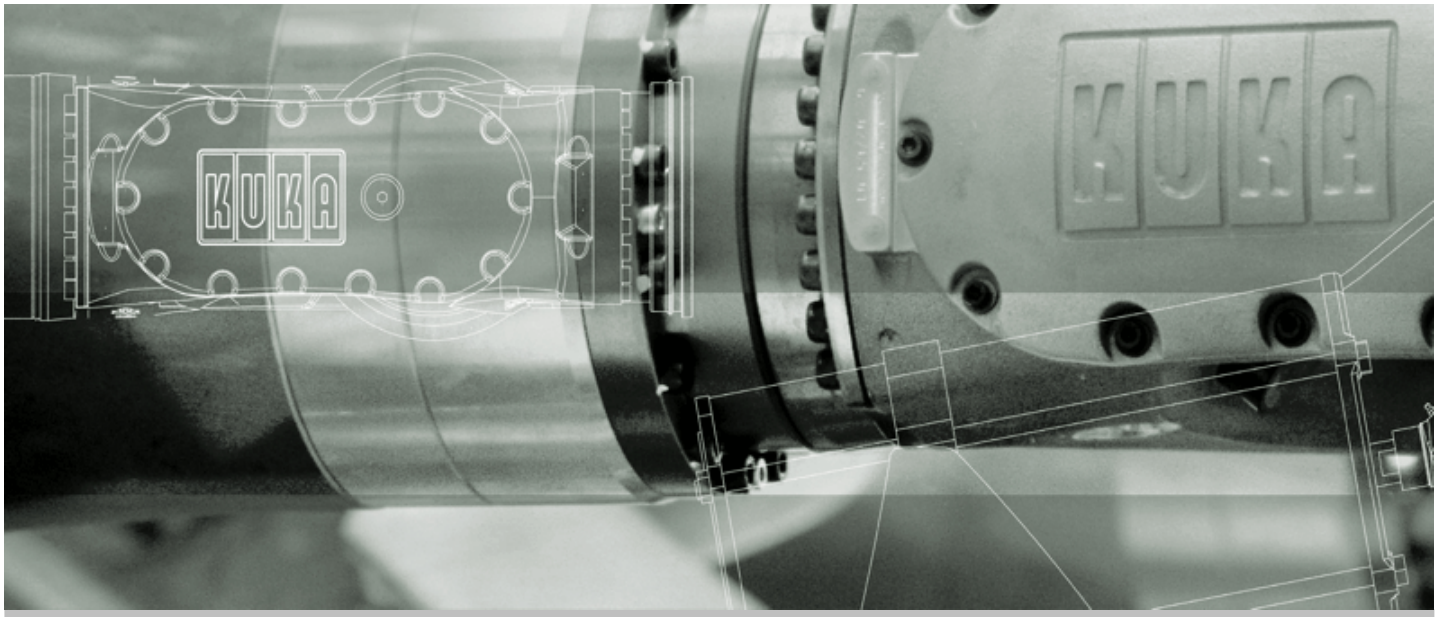

KUKA Robot Group

Communication

DeviceNet

For KR C2 edition2005 and KR C2 sr

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Contents

1 Introduction

1.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced KRL programming skills
- Advanced knowledge of the robot controller system
- Advanced knowledge of field buses

For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

1.2 Representation of warnings and notes

Safety

Warnings marked with this pictogram are relevant to safety and **must** be observed.

Danger!
This warning means that death, severe physical injury or substantial material damage **will** occur, if no precautions are taken.

Warning!
This warning means that death, severe physical injury or substantial material damage **may** occur, if no precautions are taken.

Caution!
This warning means that minor physical injuries or minor material damage **may** occur, if no precautions are taken.

Notes

Notes marked with this pictogram contain tips to make your work easier or references to further information.

Tips to make your work easier or references to further information.

1.3 Terms used

Term	Description
CAN bus	The CAN bus or (Controller Area Network) is a field bus. It is an asynchronous, serial bus system for network control devices.
DeviceNet	DeviceNet is a CAN-based field bus that is primarily used in automation technology.
Trunk line	Main line for networking the bus system. The maximum cable length is dependent on the transmission rate.
Drop line	Drop line to external bus devices. A drop line may not be more than 6 m long.
Modules	DeviceNet modules, DeviceNet devices
Configuration file	The configuration file is a text file. It contains the values of the parameters and settings.

Term	Description
DEVNET.INI	The file DEVNET.INI is the configuration file of the DeviceNet driver. During configuration, the scan list is entered via the MFC card.
IOSYS.INI	The file IOSYS.INI is the configuration file of the I/O system. This is where the bus drivers are activated and the inputs and outputs of the individual bus devices are assigned.
EDS file	The functionality of the modules is defined in the EDS file (Electronic Data Sheet).
MACID	The MACID is the module address in the bus system. It may only be issued once.
Multi-power tap	Option for the KR C2 edition2005 robot controller. It provides the power supply for the CAN bus of the robot controller (MFC). In exceptional cases, it also supplies the PFO with power.
Scan list	The MACIDs of the individual bus devices are entered in the scan list.
Telnet	Telnet is a communications software package. Telnet commands can be used to modify the baud rate for each channel of the DeviceNet card and the MACIDs of the individual DeviceNet devices.
DeviceNet card	The DeviceNet card is a 16-bit PCI-CAN card with 2 independently active DeviceNet channels.
KUKA.HMI	KUKA.HMI is the KUKA user interface.
KCP	The KCP (KUKA Control Panel) teach pendant has all the functions required for operating and programming the robot system.
MFC	The multi-function card of the robot controller with a DeviceNet connection.
PLC	A PLC (programmable logic controller) is used in systems as a higher-level master module in the bus system.

2 Product description

2.1 Overview

DeviceNet enables the communication between the robot controller and the external periphery. The following cards may be installed in the robot controller:

- MFC card
- DeviceNet card (optional)

Properties

- Fast transmission of small amounts of data
- Configurable and parameterizable across the network
- Up to 64 devices in the network
- Diagnostic facilities
- Master, multimaster
- Transmission speed of 125, 250 and 500 kBaud (baud rate)
- Maximum 128 bytes of inputs and 128 bytes of outputs per DeviceNet device
- Maximum cable length 500 m (dependent on the transmission rate)

2.2 Data transmission

Description

The field bus system consists of:

- Bus for transmission tasks (CAN bus)
- Bus protocol

The CAN bus is a serial bus system which allows all connected devices to transmit and receive. DeviceNet is a bus protocol variant.

With DeviceNet, all devices are connected in parallel (line structure), with the data cable and power supply for the bus interface in the I/O module integrated into a single cable.

2.3 MFC card

There is a DeviceNet connection on the MFC card. This card is contained as standard in every robot controller.

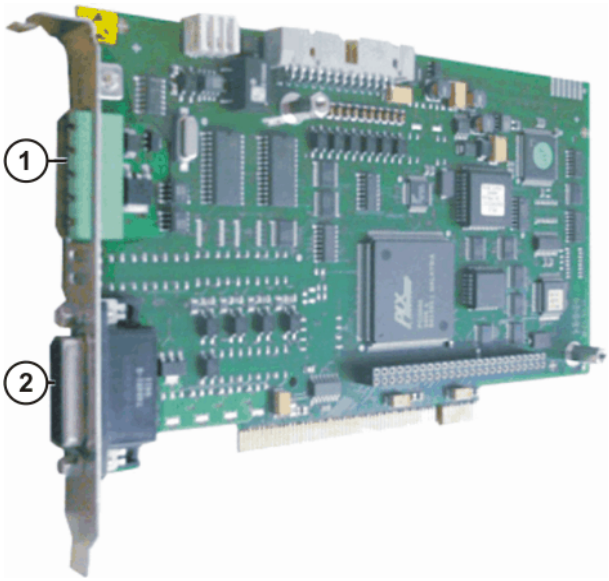


Fig. 2-1: MFC card

1	DeviceNet connection (X801: COMBICON, 5-contact)
2	Interface to CI3 board (X2: Sub-D, 26-contact)

Properties

- MFC-DeviceNet is always master with MACID 0
- Coupling/decoupling of modules not possible
- Online configuration not possible

Connections

There is a DeviceNet connection on the card (X801: COMBICON, 5-contact)

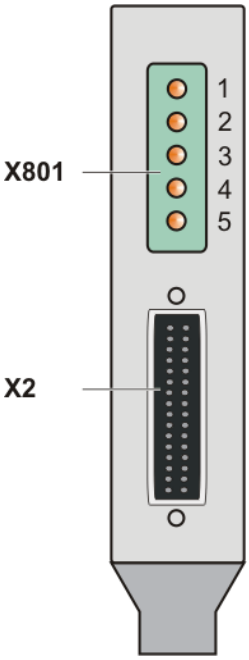


Fig. 2-2: MFC connection

Pin number on X801	Designation	Description
1	Ground	Supply voltage ground
2	CAN Low	CAN Low

Pin number on X801	Designation	Description
3	Shield	Shield
4	CAN High	CAN High
5	+24 V	Supply voltage, +24 V

2.4 Multi-power tap option (for KR C2 edition2005)

The multi-power tap is an optional board for the KR C2 edition2005 robot controller with 2 functions:

- Central feed connection point for the 24 V DC voltage for DeviceNet
- Star hub, e.g. for bus cable (DeviceNet from MFC to multi-power tap)

With this option, the CAN bus available on the MFC card is extended to the distributor module A30, allowing the connection of 2 external devices. The module is supplied with power via the additional miniature circuit-breaker F22 (2 A).

Advantage:

- Simple connection option for bus devices (3x CAN bus, 2x 24 V DC)
- Expanded bus connection (different applications, additional devices)

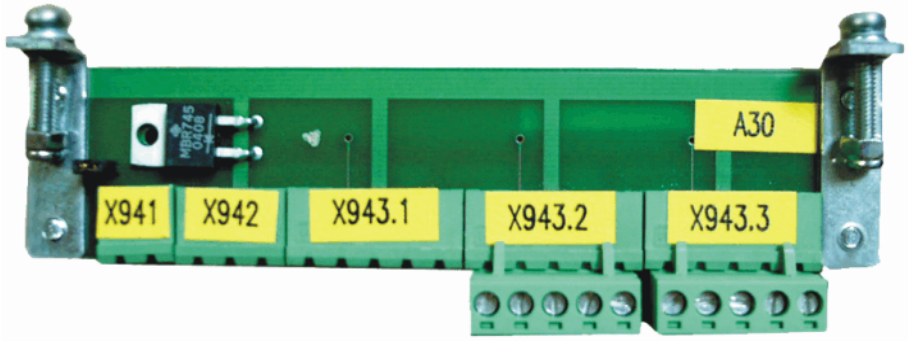


Fig. 2-3: Multi-power tap

A30	Designation for multi-power tap board
X941	24 V DC power supply
X942	24 V for diagnostic connector
X943.1	Connection for MFC DeviceNet or LPDN scanner
X943.2	Branch 1 (connection of an external device)
X943.3	Branch 2 (connection of an external device)

Further information is contained in the KUKA documentation **Multi-power tap**.

2.5 DeviceNet card

The DeviceNet card is a 16-bit PCI-CAN card with 2 independently active DeviceNet channels. The DeviceNet card is optional.

There are different DeviceNet cards for the KR C2 edition2005 and KR C2 sr robot controllers. The functionality of the cards is identical.

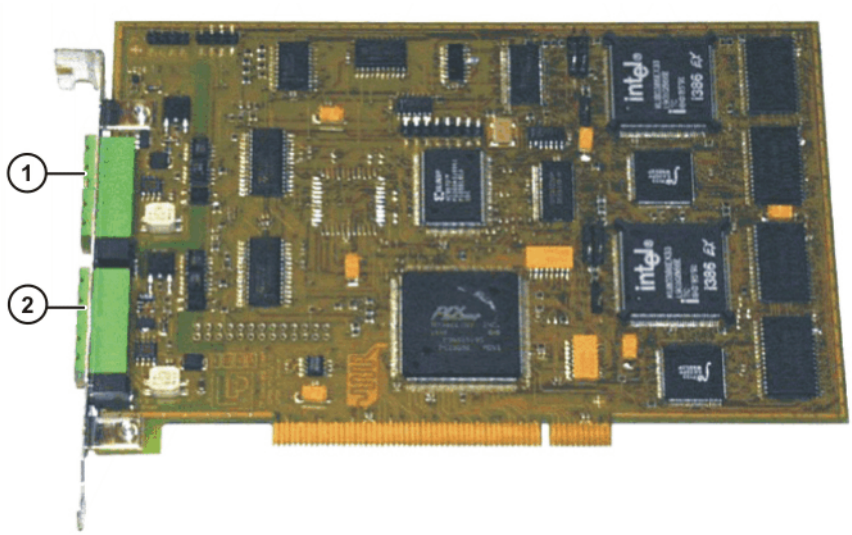


Fig. 2-4: DeviceNet card, KR C2 edition2005

1	DeviceNet connection, channel 1 (X835: COMBICON, 5-contact)
2	DeviceNet connection, channel 2 (X836: COMBICON, 5-contact)

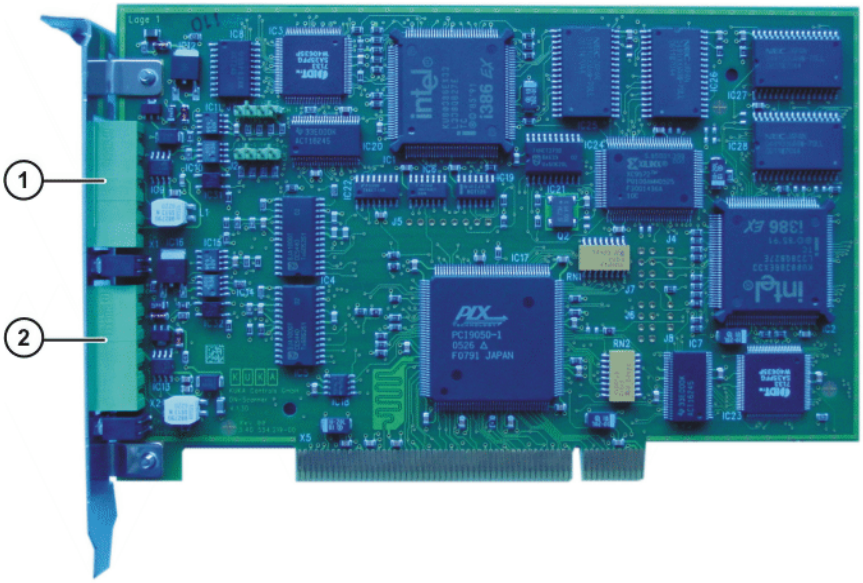


Fig. 2-5: DeviceNet card, KR C2 sr

1	DeviceNet connection, channel 1 (X835: COMBICON, 5-contact)
2	DeviceNet connection, channel 2 (X836: COMBICON, 5-contact)

Properties

- 2 independent DeviceNet channels
- Each channel can be master, slave or both
- Each channel has its own processor (386EX), memory and CAN interface
- The card is suitable for high bus utilization
- Online configuration possible
- Multimaster system possible
- Coupling/decoupling of modules possible

- All bus access types possible
- EDS file present on KUKA CD
- Certification by DeviceNet Vendor Association, Inc (ODVA)

Connections

The card has 2 DeviceNet connections. DeviceNet channel 1 is at connection X835, channel 2 at connection X836. The pin assignment of both connectors is identical.

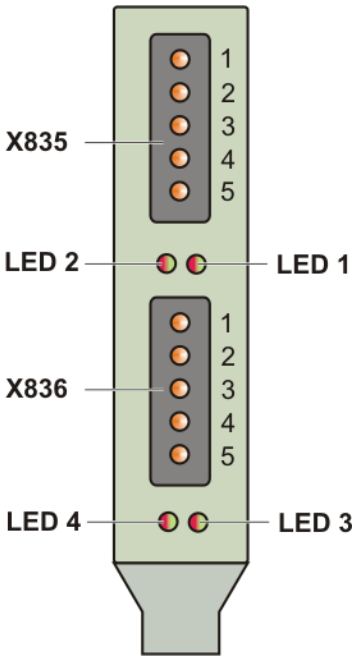


Fig. 2-6: DeviceNet card connections

Pin number on X835, X836	Designation	Description
1	Ground	Supply voltage ground
2	CAN Low	CAN Low
3	Shield	Shield
4	CAN High	CAN High
5	+24 V	Supply voltage, +24 V

LEDs

The status of the card or network is indicated by means of LEDs (red/green). LEDs 1 and 2 are assigned to channel 1 and LEDs 3 and 4 to channel 2. (>>> 8.1 "Error display" page 45)

2.5.1 Parallel operation of DeviceNet cards (only with KR C2 edition2005)

With some robot controllers, up to 3 DeviceNet cards can be used. In this case, up to 6 DeviceNet channels are available. There are corresponding drivers and configuration files for each channel. The counting sequence is implemented using the PCI bus.

It is not possible to use multiple DeviceNet cards with the KR C2 sr and KR C3 robot controllers due to their compact design.

Caution!
Only certain slots and combinations are enabled in the robot controller for parallel operation of DeviceNet cards. Other combinations must not be used. Observe the slot allocation plan of the motherboard used in the circuit diagram.

In the following figure, slots 1, 2 and 6 of the KR C2 edition2005 are enabled for the DeviceNet cards.

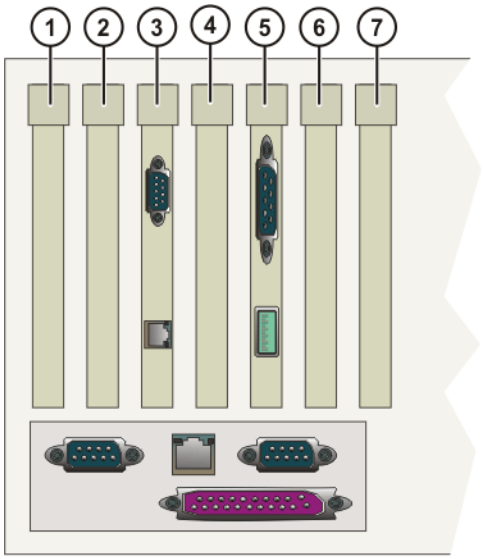


Fig. 2-7: PCI slots

The PC slots can be fitted with the following plug-in cards:

Slot	Plug-in card
1	■ Interbus card (FOC) (optional) ■ Interbus card (copper) (optional) ■ **DeviceNet card** (optional) ■ Profibus master/slave card (optional) ■ LPCN ControlNet card (optional) ■ CN_EthernetIP card (optional)
2	■ **DeviceNet card** (optional)
3	KVGA card
4	DSE-IBS-C33 AUX card (optional)
5	MFC3 card
6	■ Network card (optional) ■ **DeviceNet card** (optional) ■ Profibus master/slave card (optional) ■ LIBO-2PCI card (optional) ■ KUKA modem card (optional)
7	free

Installation

When operating two or three LPDN scanner cards in parallel, the assignment of the individual DeviceNet channels must be determined from the slot allocation. The following assignment applies:

- DeviceNet card 1: channel 1 and channel 2
- DeviceNet card 2: channel 3 and channel 4

- DeviceNet card 3: channel 5 and channel 6

The corresponding driver files and INI files must be present for each card. When installing the second card subsequently, this means:

Copy from:	to:
[CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc_1Sl.ini [CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc4drv.o	C:\Program Files\KRC\Drivers
[CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc_3Co.ini [CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc_4Co.ini	C:\Program Files\KRC\Init
[CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc_3Sl.ini [CD]:\Internat\KRCsetup\Drivers\LPDN\dnsc_4Sl.ini	C:\Program Files\KRC\Init

Use the same procedure with a third card. By default, the log files and MACIDs of the scanners are numbered the same as the corresponding channels.

2.6 Riser Cage

Description

The Riser Cage provides space for 5 PCI plug-in cards. The integrated network card forms the interface between the control unit and the power unit.

The following PC cards are plugged into the left-hand side of the Riser Cage:

- KVGA
- MFC3 Tech card

On the right-hand side of the Riser Cage are 3 PCI slots. The following PC cards can optionally be plugged in:

- Interbus PCI master
- Profibus PCI
- 3COM network card (Ethernet)
- DeviceNet card

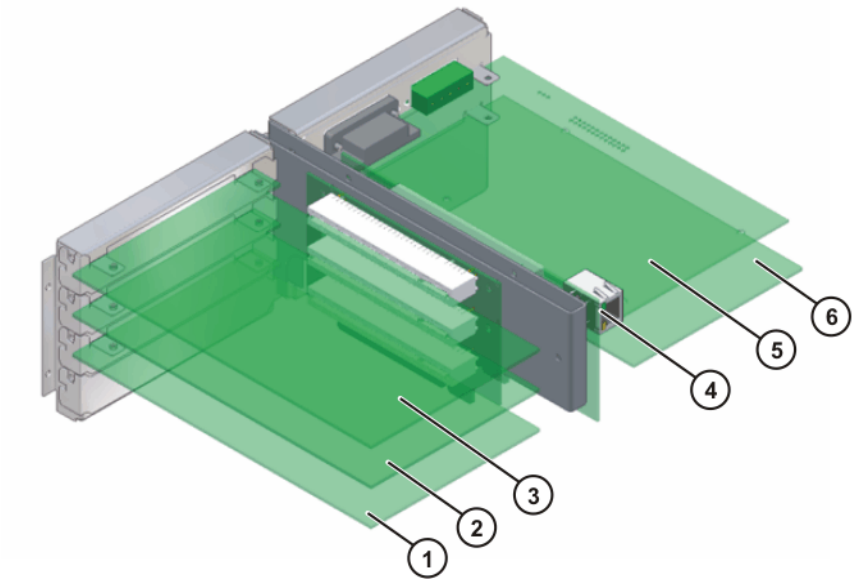


Fig. 2-8: Riser Cage configuration

Slots

Item	Interface	Item	Interface
1	Interbus Master/Slave card (optional)	4	Internal communications interface
2	Real-time or Windows network card (optional)	5	MFC3 Tech card
3	■ Profibus card (optional) ■ Windows network card (optional) ■ DeviceNet card (optional)	6	KVGA

2.7 EDS file

For each DeviceNet module there is an EDS file (Electronic Data Sheet) in which the configuration and functionality of the module are defined. The EDS file is provided by the manufacturer of the DeviceNet module.

Description

Certain values from the EDS file are required for diagnosis:

- Vendor code (manufacturer code)
- Product type (module-specific data)
- Product code (module-specific data)

Example

EDS file of the KUKA DeviceNet card:

```
:
:
[Device]
            VendCode     = 418;
            VendName     = "LP-Elektronik";
            ProdType     = 12;
            ProdTypeStr  = "Communications Adapter";
            ProdCode     = 14;
            MajRev       = 2;
            MinRev       = 52;
            ProdName     = "DeviceNet";
            Catalog      = " ";
:
:
```

2.8 DN-DIO 1620 module (for KR C2 edition2005)

The DN-DIO 1620 module is a Group 2 Only DeviceNet slave module. It has 16 digital inputs and 20 digital outputs. Each input and output has its own status LED. Outputs 0 to 15 have a maximum load rating of 0.5 A, and outputs 16 to 19 have a maximum load rating of 2 A.

Overview

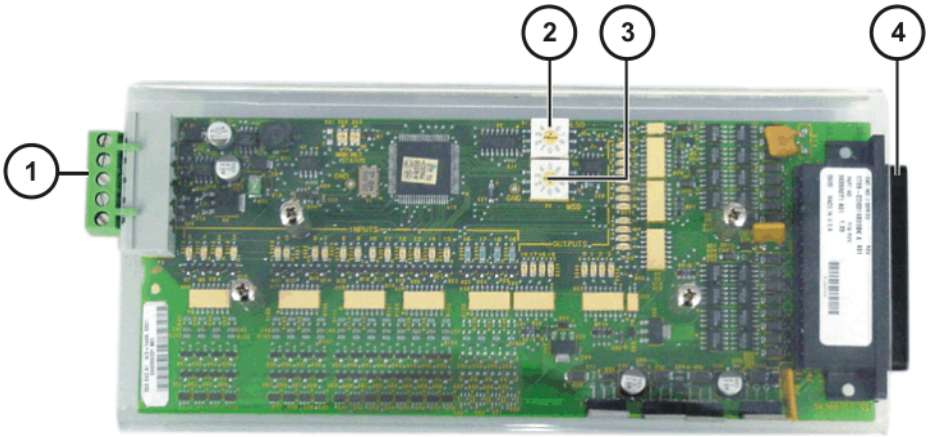


Fig. 2-9: DN-DIO 1620

1	DeviceNet connection
2	MACID setting (units position)
3	MACID setting (tens position)
4	Inputs, outputs, power supply

Use

Potential applications:

- I/O module in conjunction with the KCP2 and the CAN interface
  Only one module can be used.
- Slave module of the MFC card or the DeviceNet card
  This does not restrict its DeviceNet module functionalities in any way.

MACID

The MACID is set by means of two rotary switches. Valid values are 0 to 63. If a setting from 64 to 99 is made, the value of the most recent setting will be retained. The default value on delivery is 63.

For operation in conjunction with the CAN interface of the KCP2, the MACID must be set to 1.

If the software is configured via IOSYS.INI, the mechanical settings are overwritten.

Baud rate

The module supports baud rates of 125 kBaud, 250 kBaud and 500 kBaud. It automatically detects the baud rate which is being used (auto baud).

LEDs

The status of the card or network is indicated by means of bicolor LEDs (red/green).

(>>> 8.1 "Error display" page 45)

2.9 Bus modules

Digital and/or analog input/output modules are used as slave devices in the DeviceNet system.

Properties

- Input/output modules
- All devices must have their own address, and this address must exist only once in the bus system.
- MACID and baud rate settings via rotary switches or DIP switches (address 0 to 63)
- Structure and setting mode are manufacturer-specific

Observe manufacturer information before connection, configuration and start-up.

3 Installation

3.1 Overview

DeviceNet cables are routed from one device to the next.

- The maximum power consumption of the DeviceNet master is 25 mA.
- The power consumption of the DeviceNet modules depends on the specific modules.
- The negative potential of the supply voltage must always be grounded.

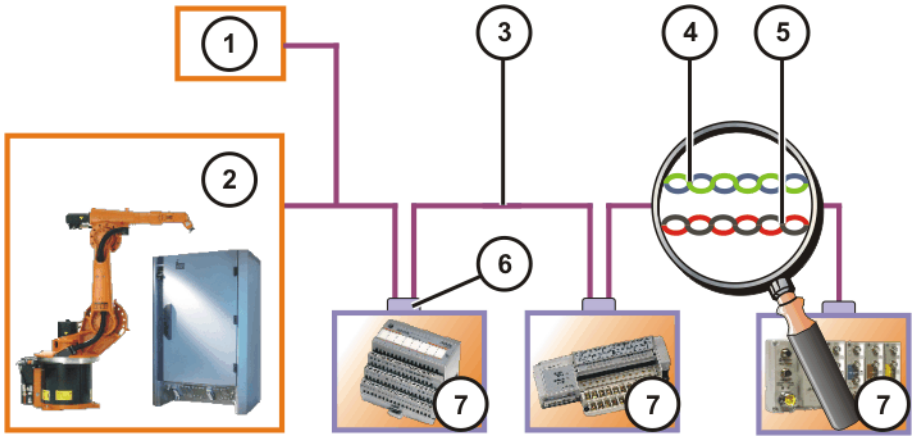


Fig. 3-1: DeviceNet, connection example

1	24 V DC power supply
2	DeviceNet master connection
3	DeviceNet cable
4	DeviceNet cable (data)
5	DeviceNet cable (power supply)
6	DeviceNet connector
7	DeviceNet device

Many slave modules have only a single DeviceNet connection. These employ connectors which can be connected to two DeviceNet cables. The bus is not interrupted when they are disconnected.

3.2 Connectors

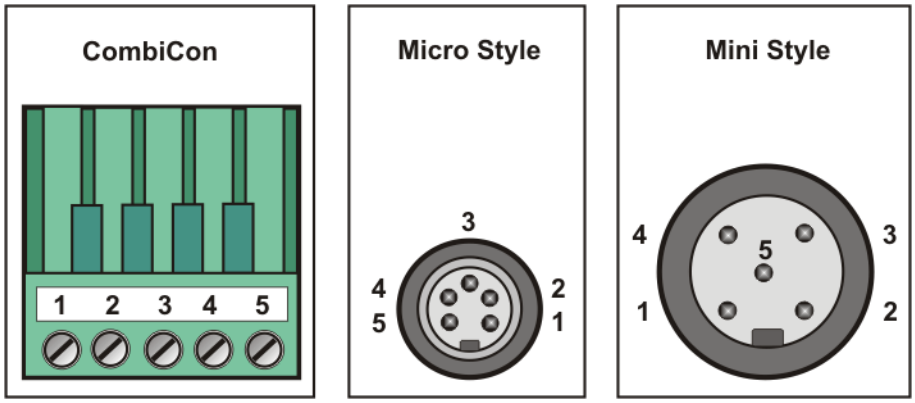


Fig. 3-2: DeviceNet connector

Connector	Pin	Connection
CombiCon	1	0 V power supply
	2	CAN Low signal
	3	Shield
	4	CAN High signal
	5	+24 V power supply
Micro Style	1	Shield
	2	+24 V power supply
	3	0 V power supply
	4	CAN High signal
	5	CAN Low signal
Mini style	1	Shield
	2	+24 V power supply
	3	0 V power supply
	4	CAN High signal
	5	CAN Low signal

3.3 Cables

DeviceNet requires two strand pairs and a shield.

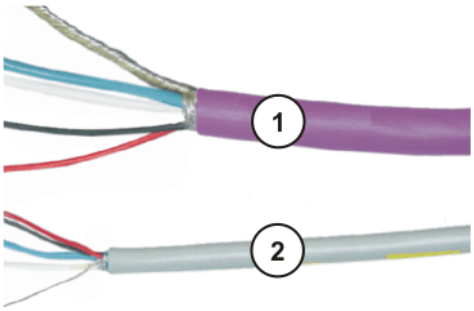


Fig. 3-3: DeviceNet cable example

1 Thick cable
2 Thin cable

Thick cables are mainly used as main lines (trunk lines), while thin cables are used as drop lines.

Wire color	Meaning
Black	0 V power supply
Red	+24 V power supply
Bare	Shield
Blue	CAN Low signal
White	CAN High signal

The power supply in the DeviceNet cable may only be used for the bus interface in the I/O module. The outputs must be supplied with power separately.

3.4 Grounding

The shield of the DeviceNet cable must be grounded once. For preference, the shield is grounded in the robot controller.

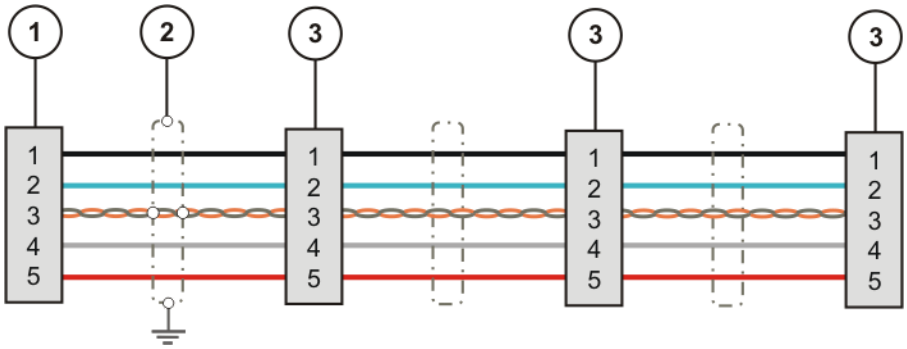


Fig. 3-4: DeviceNet cable grounding

1	DeviceNet master connection (robot controller)
2	Shield (grounded)
3	DeviceNet device

3.5 Cable length

The maximum cable length is dependent on the transmission rate. The following applies here:

- 125 kbit/s – max. cable length: 500 m
- 250 kbit/s – max. cable length: 200 m
- 500 kbit/s – max. cable length: 100 m

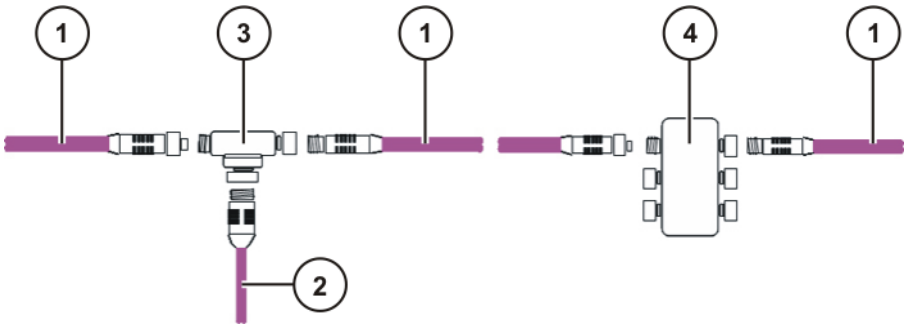


Fig. 3-5: Cable connection example

1	Trunk line
2	Drop line
3	T tap
4	Multiport tap

A drop line may not be more than 6 m long.
KUKA recommendation: do not use drop lines.

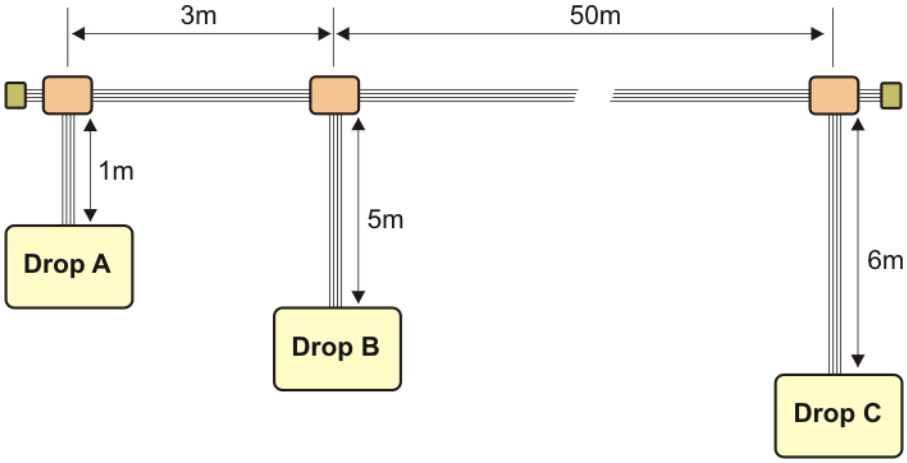


Fig. 3-6: Cable length example

To determine the maximum cable length, the longest communication distance between connections must be taken into consideration.

Distance	Calculation	Total
From A to C	1 + 3 + 50 + 6	60 m
From B to C	5 + 50 + 6	61 m

Since the cable length from A to the first distributor is only 4 m, only the 5 m drop line from B to the first distributor is is taken into consideration. This gives a cable length of 61 m.

3.6 Bus terminator

The trunk lines at each of the two furthest points in the DeviceNet must each have a terminating resistor. Terminators are not connected to drop lines.

The terminating resistors used with DeviceNet vary according to the supplier:

- Terminating resistor (resistance 121 Ω)
- Bus coupler with terminator

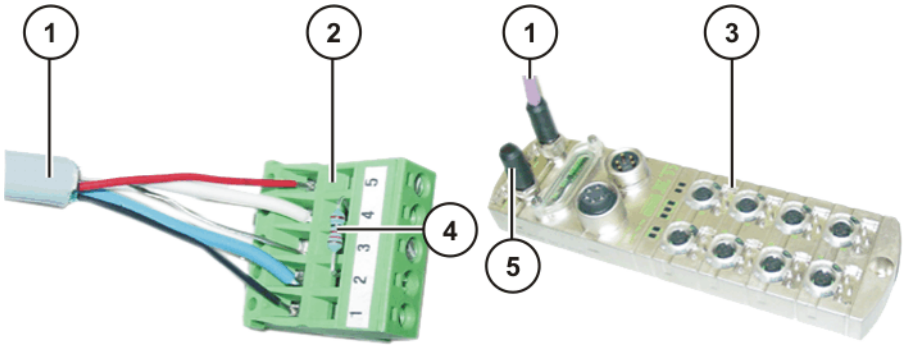


Fig. 3-7: DeviceNet terminator examples

1 DeviceNet cable
2 DeviceNet terminating resistor (robot controller)
3 Bus coupler
4 Terminator 121 Ω, +/- 1%
5 Terminator on bus coupler

Modules connected with hybrid Multibus cables do not require terminators. These modules automatically activate the terminator.

4 DeviceNet connection

4.1 Connection via MFC card

When connecting the DeviceNet via the MFC card, a maximum of 20 devices (MACID 1 to MACID 19) can be used, as the MFC DeviceNet driver increases the load on the main processor of the robot controller. The MFC card always has the MACID 0.

A DeviceNet connection always requires a 24 V DC supply voltage.

Example

In the case of a connection via the MFC card, the DeviceNet cable goes from one device to the next. The devices may be arranged as desired.

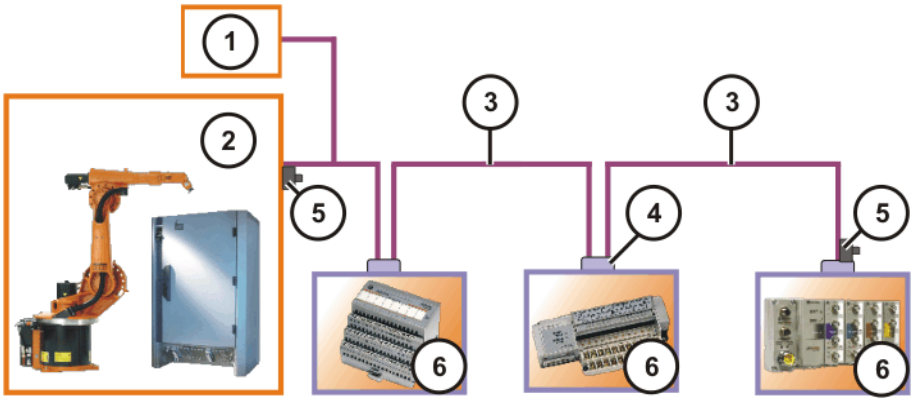


Fig. 4-1: Connection example: robot controller - MFC DeviceNet

1	24 V DC power supply	4	DeviceNet connector
2	MFC-DeviceNet master connection	5	Terminator
3	DeviceNet cable	6	DeviceNet device

4.2 Connection via DeviceNet card

In the DeviceNet structure, the DeviceNet card can be master, slave or both. A maximum of 64 devices (MACID 0 to MACID 63) can be connected, with the DeviceNet card also counting as a device.

Example

In this connection example, the DeviceNet master connection is illustrated with a higher-level PLC. The robot controller is DeviceNet slave and DeviceNet master.

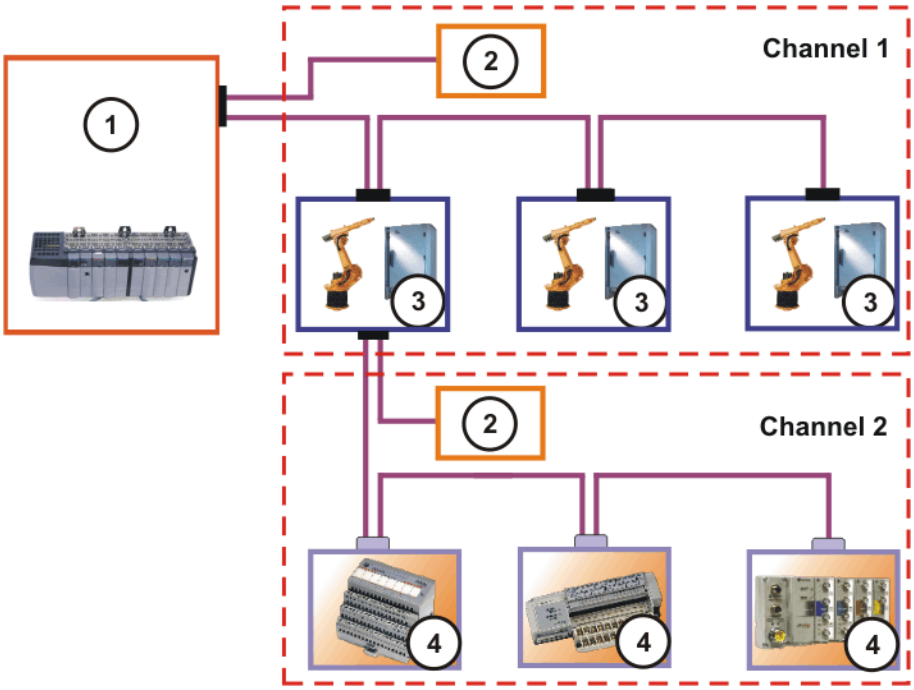


Fig. 4-2: Connection example: robot controller - DeviceNet

1	PLC DeviceNet master connection
2	24 V DC power supply
3	Robot controller
4	DeviceNet device
Channel 1	Slave
Channel 2	Master

5 Configuration

5.1 Configuring a DeviceNet connection via the MFC card

The DeviceNet configuration files are in the directory **C:\KRC\Roboter\INIT**.

Overview

Step	Description
1	Configure the file DEVNET.INI. (>>> 5.2 "Configuring the file DEVNET.INI" page 25)
2	Configure the file IOSYS.INI. (>>> 5.3 "Configuring the IOSYS.INI file" page 26)
3	Configure the baud rate via Telnet. (>>> 5.4 "Configuration via Telnet commands" page 27)
4	Configure the MACID via Telnet. (>>> 5.4.3 "Changing the MACID" page 28)

Description

Directory	Meaning
C:\KRC\Roboter\INIT\	Directory of the configuration files
C:\KRC\Roboter\LOG	Directory of the log files
C:\KRC\Roboter\DRIVERS	Directory of the driver programs

File	Meaning
INIT\IOSYS.INI	Configuration file of the I/O system
INIT\DEVNET.INI	Configuration file of the DeviceNet driver
DRIVERS\DN2DRV.O	DeviceNet driver

5.2 Configuring the file DEVNET.INI

The file DEVNET.INI is the configuration file of the DeviceNet driver.

Precondition

- All communications cables have been installed.
- User group “Expert”
- Windows interface (CTRL+ESC)

Procedure

1. Open the file DEVNET.INI in the directory C:\KRC\ROBOTER\INIT.
2. Make settings.
3. Select the menu sequence **Configure** > **I/O Driver** > **Reconfigure I/O Driver**.
   The settings are saved.

The menu item **Reset** restarts the bus. Changes are not saved.

Description

```
[krc]
DEBUG=0
BAUDRATE=500
LOGFILE=1
[1]
Macid=3
[2]
Macid=7
[3]
Macid=45
```

DEVNET.INI	Description
[KRC]	Shows Telnet display settings, transmission rate and log file generation
DEBUG	Advanced diagnostic information (optional) ■ 0 = off ■ 1 = on ■ Default setting: 0
BAUDRATE	Transmission rate setting in kBaud ■ Permissible values: 125, 250, 500 ■ Default setting: 500
LOGFILE	Optional entry for generating a log file ■ 1 = log file is generated (name: DEVNET.LOG, directory: C:\KRC\Robot-er\Log) ■ Default setting: no entry
MACID	MACIDs must be specified in ascending order. ■ Permissible values: 0...63 ■ Default setting: 5
[1]...[63]	Scan list for entering the MACIDs. The numbers in square brackets must be specified consecutively in ascending order.

The MACID of the master does not need to be specified.

5.3 Configuring the IOSYS.INI file

The file IOSYS.INI is the configuration file of the I/O system.

Precondition

- All communications cables have been installed.
- User group “Expert”

Procedure

1. Select the menu sequence **Configure** > **I/O Driver** > **Edit I/O Config.**.
   The file IOSYS.INI is opened.
2. In [DRIVERS]: activate DEVNET=2,dnInit,dn2drv.o by deleting the comment separator.
3. In [DEVNET]: assign inputs and outputs to the individual bus devices.
   (>>> 6.1 "Assigning digital inputs and outputs" page 35)
   (>>> 6.2 "Assigning analog inputs and outputs" page 36)
4. Select the menu sequence **Configure** > **I/O Driver** > **Reconfigure I/O Driver**.
   The settings are saved.

The menu item **Reset** restarts the bus. Changes are not saved.

Description

```
[CONFIG]
VERSION=2.00
[DRIVERS]
...
...
DEVNET=2,dnInit,dn2drv.o
...
...
[DEVNET]
;E/A-Zuordungen Devicenet
```

IOSYS.INI	Description
[CONFIG]	Indication of the version number
[DRIVERS]	Lines for activation of the bus drivers
DEVNET=2,dnInit,dn2drv.o	DeviceNet driver
[DEVNET]	Lines for assignment of the inputs and outputs of the selected bus devices

5.4 Configuration via Telnet commands

Telnet commands can be used to modify the baud rate and MACIDs of the individual DeviceNet devices.

5.4.1 Opening Telnet

Procedure

1. Click on the Windows **Start** button.
2. Select the menu option **Run...**.
3. In the **Open** box, enter.
   - Windows 95: **Telnet 192.0.1.1**
   - Windows XP Security Patch 2 or higher: **Telnetk 192.0.1.1**
4. Click on **OK**.
   The Telnet window is opened.

In all Telnet entries: observe upper/lower case!

5.4.2 Changing the baud rate

The baud rate can be displayed using the Telnet command **dnSetBaudRate**.

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. Enter **dnSetBaudRate** (**MACID**),(**new baud rate**).
3. Press **Enter**.

Example

```
-> dnSetBaudRate 63,2_
```

Entry	Description
dnSetBaudRate	Baud rate change text
63	MACID
2	New baud rate 500 kBaud (0 = 125 kBaud, 1 = 250 kBaud, 2 = 500 kBaud)

5.4.3 Changing the MACID

The MACID can be changed using the Telnet command **dnSetMacId**.

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. Enter **dnSetMacId** (**old MACID**), (**new MACID**).
3. Press **Enter**.

Example

```
-> dnSetMacId 63,12_
```

Entry	Description
dnSetMacId	MACID change text
63	Old MACID
12	New MACID

5.5 Configuring the DeviceNet card

The DeviceNet configuration files are in the directory **C:\KRC\Roboter\INIT**.

Overview

Step	Description
1	Configure the file DNSC_XCO.INI. (>>> 5.7 "Configuring the file DNSC_xSL.INI" page 30)
2	Configure the file DNSC_XSL.INI. (>>> 5.6 "Configuring the file DNSC_xCO.INI" page 29)
3	Configure the file IOSYS.INI. (>>> 5.8 "Configuring the file IOSYS.INI" page 32)
4	Configure the baud rate via Telnet. (>>> 5.9 "Configuration via Telnet commands" page 33)
5	Configure the MACID via Telnet. (>>> 5.4.3 "Changing the MACID" page 28)

Description

Directory	Meaning
C:\KRC\Roboter\INIT\	Directory of the configuration files
C:\KRC\Roboter\LOG	Directory of the log files
C:\KRC\Roboter\DRIVERS	Directory of the driver programs

File	Meaning
INIT\IOSYS.INI	Configuration file of the I/O system
INIT\DNSC_XCO.INI	Master configuration file of the corresponding DeviceNet channel (X=channel number: 1, 3, 5)
INIT\DNSC_XSL.INI	Configuration file of the corresponding Device-Net channel (X=channel number: 2, 4, 6) ■ For the connected bus modules ■ If channel X is used as a slave
DRIV-ERS\DNSCXDRV.O	Driver for the corresponding DeviceNet channel (X=channel number 1-6)
DRIVERS\DNSCB-DRV.O	Driver of the firmware file
DRIV-ERS\DNSCFDRV.O	Firmware file

5.6 Configuring the file DNSC_xCO.INI

Description

The file DNSC_xCO.INI is the master configuration file of the corresponding DeviceNet channel (x=channel number).

Precondition

- All communications cables have been installed.
- User group “Expert”
- Windows interface (CTRL+ESC)

Procedure

1. Open the file DNSC_xCO.INI in the directory C:\KRC\ROBOTER\INIT.
2. Make settings.
3. Select the menu sequence **Configure** > **I/O Driver** > **Reconfigure I/O Driver**.
   The settings are saved.

The menu item **Reset** restarts the bus. Changes are not saved.

Description

```
[CONFIG]
MAC_ID=1
BAUDRATE=500
LOGFILE=log/dnsc1.log
DEBUG=1
; USE_ERROR_DB=      ; use default value
; SCANLIST_COMMENT=  ; use default value
; OPTIONS=           ; use default value

[FAST_OUT]
; MAC_ID=10          ; not activated
```

DNSC_xCO.INI	Description
[CONFIG]	Channel configuration
MAC_ID	MACID of the DeviceNet channel ■ Permissible values: 0...63
BAUDRATE	Transmission rate (baud rate) setting in kBaud ■ Permissible values: 125, 250, 500 ■ Default setting: 500

DNSC_xCO.INI	Description
LOGFILE	Entry (name and path) after generation of a log file (optional) ■ log/dnsc1.log for channel 1 ■ log/dnsc2.log for channel 2
DEBUG	Advanced diagnostic information (optional) ■ 0 = off ■ 1 = on ■ Default setting: 0
USE_ERROR_DB	Defines whether the language database of the robot is to be used (optional) ■ 0 = do not use database ■ 1 = use database ■ Default setting: 0
SCANLIST_COMMENT	Comments are generated in the scan list during configuration with RSNetworx (optional) ■ 0 = off ■ 1 = on ■ Default setting: 0
OPTIONS	Customer-specific options that may only be entered if expressly instructed to do so by the KUKA Robot Group (optional) ■ 0 = off ■ 1 = on ■ Default setting: 0
[FAST_OUT]	Fastwrite MACID (fast outputs)
MAC_ID	■ Permissible values: 0...63 ■ Deactivation is possible by specification of an invalid value or deletion of the entry ■ Default setting: deactivated

5.7 Configuring the file DNSC_xSL.INI

Description

The file DNSC_xSL.INI is the configuration file of the corresponding DeviceNet channel (x=channel number).

Precondition

- All communications cables have been installed.
- User group “Expert”
- Windows interface (CTRL+ESC)

Procedure

1. Open the file DNSC_xSL.INI in the directory C:\KRC\ROBOTER\INIT.
2. Make settings.
3. Select the menu sequence **Configure** > **I/O Driver** > **Reconfigure I/O Driver**.

   The settings are saved.

The menu item **Reset** restarts the bus. Changes are not saved.

Description

```
[MODULE_STARTUP]
INACTIV=                    ; Example: 1,5,6
CONTINUE_WITH_WARNING=; Example: 8,25

[SCANNERCFG]
NET_EPR=75
NET_ISD=2
NET_BACKGROUND_POLL_RATE=1
NET_TX_RETRY_COUNT=1

[1]                     ;Slave number
MAC_ID=1                ;0-63
VENDOR_ID=418           ;device keying info
PRODUCT_TYP=12          ;device keying info
PRODUCT_CODE=14         ;device keying info
POLL_RESPL=8            ;number of inputbytes
POLL_CMDL=8             ;number of outputbytes

[2]
...
```

DNSC_xCO.INI	Description
[MODULE_STARTUP]	Start settings
INACTIV	Display, e.g. in the case of a tool change ■ Permissible values: 0...63 ■ Default setting: deactivated
CONTINUE_WITH_WARNING	The active program is not stopped, although one of the listed devices is faulty ■ Permissible values: 0...63 ■ Default setting: deactivated
[SCANNERCFG]	Scanner configurations
NET_EPR	Expected packet rate (EPR) ■ Permissible values: 10...32000 The value must be multiplied by 4 to obtain the time value in ms. Example 4x75=300 ms. If there is no communication between the scanner and the DeviceNet device in this time, this module is no longer addressed. The scanner additionally attempts to reinitialize the module. ■ Default setting: 75
NET_ISD	Wait time in ms between 2 scan cycles ■ Permissible values: 2...9000 ■ Default setting: 2
NET_BACKGROUND_POLL_RATE	Polling rate: foreground, background ■ 0 = background ■ 1 = foreground ■ Default setting: 1
NET_TX_RETRY_COUNT	Counting pulse repetition ■ Default setting: 1
[1]...[63]	The MACIDs are specified in ascending order in this scan list.
MACID	Module address ■ Permissible values: 0...63

DNSC_xCO.INI	Description
VENDOR_ID	ID number (specific to the module manufacturer)
PRODUCT_TYPE	Manufacturer-specific value
PRODUCT_CODE	Manufacturer-specific value
POLL_RESPL	Number of module input bytes
POLL_CMDL	Number of module output bytes

5.8 Configuring the file IOSYS.INI

Description

The file IOSYS.INI is the configuration file of the I/O system.

Precondition

- All communications cables have been installed.
- User group “Expert”

Procedure

1. Select the menu sequence **Configure** > **I/O Driver** > **Edit I/O Config.**.
   The file IOSYS.INI is opened.
2. In [DRIVERS]:
   - Activate **DNSC1=12,dnsc1Init,dnsc1drv.o** for DeviceNet card channel 1.
   - Activate **DNSC2=13,dnsc2Init,dnsc2drv.o** for DeviceNet card channel 2.
3. In [DNSC1]: assign inputs and outputs (channel 1) of the individual bus devices.
4. In [DNSC2]: assign inputs and outputs (channel 2) of the individual bus devices.
5. Select the menu sequence **Configure** > **I/O Driver** > **Reconfigure I/O Driver**.
   The settings are saved.

The menu item **Reset** restarts the bus. Changes are not saved.

Description

```
[CONFIG]
VERSION=2.00

[DRIVERS]
...
DNSC1=12,dnsc1Init,dnsc1drv.o
DNSC2=13,dnsc2Init,dnsc2drv.o
...
...

[DNSC1]
;E/A-Zuordungen DeviceNet Kanal 1

[DNSC2]
;E/A-Zuordungen DeviceNet Kanal 2
```

IOSYS.INI	Description
[CONFIG]	Indication of the version number
[DRIVERS]	Lines for activation of the bus drivers
DNSC1=12,dnsc1Init,dnsc1drv.o	DeviceNet driver channel 1

IOSYS.INI	Description
DNSC2=13,dnsc2Init,dnsc2drv.o	DeviceNet driver channel 2
[DNSC1]	Lines for assignment of the inputs and outputs of the selected bus devices, channel 1
[DNSC2]	Lines for assignment of the inputs and outputs of the selected bus devices, channel 2

5.9 Configuration via Telnet commands

Telnet commands can be used to modify the baud rate for each channel of the DeviceNet card and the MACIDs of the individual DeviceNet devices.

5.9.1 Opening Telnet

Procedure

1. Click on the Windows **Start** button.
2. Select the menu option **Run...**.
3. Enter the following in the **Open** box:
   - Windows 95: **Telnet 192.0.1.1**
   - Windows XP Security Patch 2 or higher: **Telnetk 192.0.1.1**
4. Click on **OK**.
   The Telnet window is opened.

In all Telnet entries: observe upper/lower case!

5.9.2 Changing the baud rate

The baud rate can be displayed using the Telnet command **dnSetBaudRate**.

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. Enter **dnSetBaudRate** (**MACID**),(**new baud rate**).
3. Press **Enter**.

Example

```
-> dnSetBaudRate 63,2_
```

Entry	Description
dnSetBaudRate	Baud rate change text
63	MACID
2	New baud rate 500 kBaud (0 = 125 kBaud, 1 = 250 kBaud, 2 = 500 kBaud)

5.9.3 Changing the MACID

The MACID can be changed using the Telnet command **dnscxSetMacId** (x=channel number).

Procedure

1. Open Telnet window.

2. For channel 1: enter **dnsc1SetMacId** (**old MACID**), (**new MACID**).
3. Press **Enter**.
4. For channel 2: enter **dnsc2SetMacId** (**old MACID**), (**new MACID**).
5. Press **Enter**.

Example

```
-> dnsc1SetMacId 4,14_
```

Entry	Description
dnsc1SetMacId	MACID change text (channel 1)
4	Old MACID
14	New MACID

6 I/O assignment

6.1 Assigning digital inputs and outputs

Procedure

1. Open the file **IOSYS.INI**.
2. Assign inputs and outputs in **[DEVNET]**.

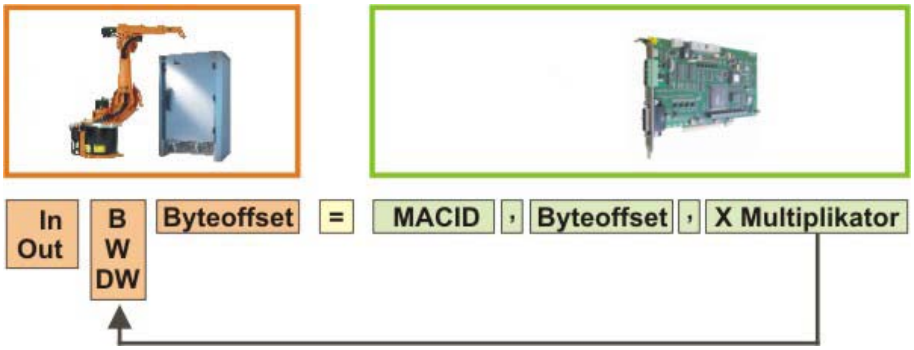


Fig. 6-1: Overview: assignment of digital I/Os

Description

I/O position specifications in robot controller	
IN	Robot controller input
OUT	Robot controller output
B	Byte = 8 bits (signals)
W	Word = 2 bytes = 16 bits (signals)
DW	Double word = 2 words = 4 bytes = 32 bits (signals)
Byte offset	The byte offset values (0 to 127) are counted once for the digital inputs and once for the digital outputs. Multiple assignment is not possible for any memory position in the I/O system.

MFC card input memory	
MACID	The DeviceNet address (1 to 63) is set on each module.
Byte offset	The byte offset designates the position of the I/Os in the memory of the DeviceNet device and is counted once for all inputs and once for all outputs (0 to 127).
Multiplier	The multiplier is used to define the address range width of the connected devices (multiplier value 1, 2, 3, ...) to allow a possible subsequent address expansion.

Example

- Device 1: I/O module with MACID 3:
  16 digital inputs, 16 digital inputs, 16 digital outputs

The first inputs of device 1 should have a data width of 2 bytes (1 word) and be assigned to input address 0 of the robot controller. The MACID of device 1 is 3. Address range 0 is defined and the range width remains unchanged (x1):

```
INW0=3,0,x1
```

The next inputs should have a data width of 8 bits (1 byte) and be assigned to input address 2 of the robot controller. The MACID of device 1 is 3. Address range 2 is defined and the range width is doubled (x2):

```
INB2=3,2,x2
```

The outputs should have a data width of 2 bytes (1 word) and be assigned to output address 0 of the robot controller. The MACID of device 1 is 3. Address range 0 is defined and the range width remains unchanged (x1):

```
OUTW0=3,0,x1
```

Entry for device 1 in IOSYS.INI:

```
[DEVNET]
; Devicenet MACID 3
INW0=3,0,x1   ; $IN[1-16]
INB2=3,2,x2   ; $IN[17-32]
OUTW0=3,0,x1  ; $OUT[1-16]
```

Further examples under (>>> 7.3 "Assigning digital inputs/outputs" page 43).

6.2 Assigning analog inputs and outputs

Procedure

1. Open the file **IOSYS.INI**.
2. Assign inputs and outputs in **[DEVNET]**.

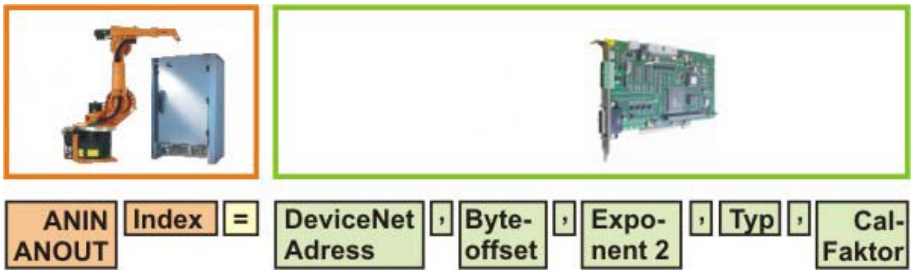


Fig. 6-2: Overview: assignment of analog I/Os

Description

Robot controller	
ANIN	Robot controller input
ANOUT	Robot controller output
Index	■ 1 to 16 for inputs ■ 1 to 32 for outputs

Multiple assignment is not possible for any memory position in the I/O system.

DeviceNet	
DeviceNet address	The DeviceNet address (1 to 63) is set on each DeviceNet module.
Byte offset	The byte offset designates the position of the I/Os in the memory of the DeviceNet device and is counted once for all inputs and once for all outputs (0 to 127).
Exponent 2	This parameter specifies the number of bits used to represent the numeric value of an analog value (8 to 16).

DeviceNet	
Type	This parameter specifies how the bits in the parameter **Exponent 2** are arranged and whether or not the leading bit should be interpreted as a plus/minus sign before the numeric value. The possible parameter values have the following meanings: ■ 0: right-justified without sign ■ 1: right-justified with sign ■ 2: left-justified without sign ■ 3: left-justified with sign
Cal factor	The Cal factor specifies the value at which an analog output generates its nominal value (e.g. 10 V). For an analog input, the value of the Cal factor corresponds to the nominal input value.

The Cal factor is a value defined by the manufacturer for identifying the module. There is no need to enter it in the scan list.

Example

- Device 2: I/O module with MACID 4:
  2 analog inputs, 2 analog outputs

Input 1 of device 2 is to be assigned to input address 1 of the robot controller. The MACID of device 2 is 4. The defined address range (position of the I/Os in the memory of the DeviceNet device) is 1 and the defined representation width of the individual bits is 16. Alignment 3 (left-justified with sign) is specified and the value defined by the manufacturer (Cal factor) is entered:

```
ANIN1=4,1,16,3,CAL32768
```

Input 2 of device 2 is to be assigned to input address 2 of the robot controller. Address range 3 is defined. MACID, representation width, alignment and Cal factor remain unchanged:

```
ANIN2=4,3,16,3,CAL32768
```

Output 1 of device 2 is to be assigned to output address 1 of the robot controller. Address range 0 is defined. MACID, representation width, alignment and Cal factor remain unchanged:

```
ANOUT1=4,0,16,3,CAL32768
```

Output 2 of device 2 is to be assigned to output address 2 of the robot controller. Address range 2 is defined. MACID, representation width, alignment and Cal factor remain unchanged:

```
ANOUT2=4,2,16,3,CAL32768
```

Entry for device 2 in IOSYS.INI:

```
[DEVNET]
; Devicenet MACID 4
ANIN1=4,1,16,3,CAL32768     ; $ANIN[1]
ANIN2=4,3,16,3,CAL32768     ; $ANIN[2]
ANOUT1=4,0,16,3,CAL32768    ; $ANOUT[1]
ANOUT2=4,2,16,3,CAL32768    ; $ANOUT[2]
```

Further examples under (>>> 7.4 "Assigning analog inputs/outputs" page 43).

6.3 Offset-Table

The offset byte and the related input and output addreses are specified in this table.

Formula for start address: Offset x 8 + 1

Byte	Address from	Address to		Byte	Address from	Address to
0	1	8		64	513	520
1	9	16		65	521	528
2	17	24		66	529	536
3	25	32		67	537	544
4	33	40		68	545	552
5	41	48		69	553	560
6	49	56		70	561	568
7	57	64		71	569	576
8	65	72		72	577	584
9	73	80		73	585	592
10	81	88		74	593	600
11	89	96		75	601	608
12	97	104		76	609	616
13	105	112		77	617	624
14	113	120		78	625	632
15	121	128		79	633	640
16	129	136		80	641	648
17	137	144		81	649	656
18	145	152		82	657	664
19	153	160		83	665	672
20	161	168		84	673	680
21	169	176		85	681	688
22	177	184		86	689	696
23	185	192		87	697	704
24	193	200		88	705	712
25	201	208		89	713	720
26	209	216		90	721	728
27	217	224		91	729	736
28	225	232		92	737	744
29	233	240		93	745	752
30	241	248		94	753	760
31	249	256		95	761	768
32	257	264		96	769	776
33	265	272		97	777	784
34	273	280		98	785	792
35	281	288		99	793	800

Byte	Address from	Address to		Byte	Address from	Address to
36	289	296		100	801	808
37	297	304		101	809	816
38	305	312		102	817	824
39	313	320		103	825	832
40	321	328		104	833	840
41	329	336		105	841	848
42	337	344		106	849	856
43	345	352		107	857	864
44	353	360		108	865	872
45	361	368		109	873	880
46	369	376		110	881	888
47	377	384		111	889	896
48	385	392		112	897	904
49	393	400		113	905	912
50	401	408		114	913	920
51	409	416		115	921	928
52	417	424		116	929	936
53	425	432		117	937	944
54	433	440		118	945	952
55	441	448		119	953	960
56	449	456		120	961	968
57	457	464		121	969	976
58	465	472		122	977	984
59	473	480		123	985	992
60	481	488		124	993	1000
61	489	496		125	1001	1008
62	497	504		126	1009	1016
63	505	512		127	1017	1024

7 Example

7.1 DeviceNet connection via the MFC card

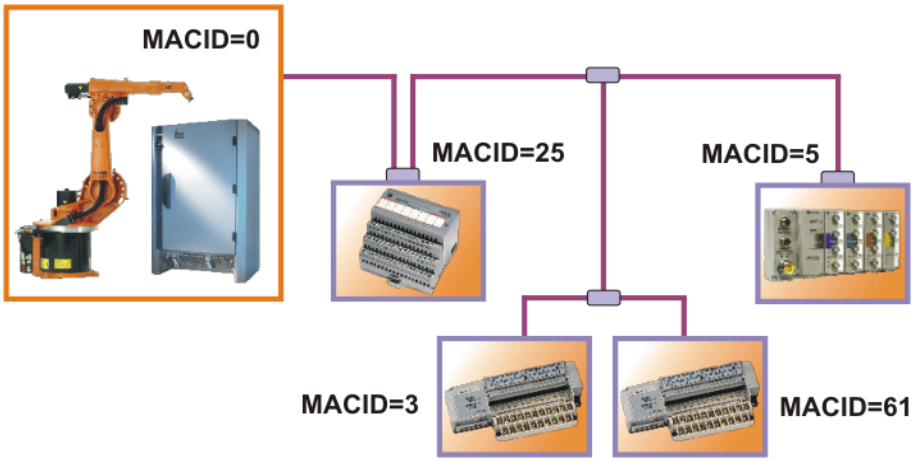


Fig. 7-1: Connection example

DEVNET.INI

```
[krc]
debug=0
baudrate=500
LOGFILE=1
[1]
Macid=3
[2]
Macid=5
[3]
Macid=25
[4]
Macid=61
```

The entries in the scan list are always made in ascending order, while the DeviceNet devices can be connected in any order.

The MACID of the master does not need to be specified.

7.2 DeviceNet connection via the DeviceNet card

Channel 1 of the DeviceNet card is simultaneously the slave of the PLC and the master of 2 I/O modules.

Bus structure with:

- Master module
- Robot controller with MACID 1: 32 inputs, 32 outputs
- I/O module with MACID 7: 16 inputs, 16 outputs
- I/O module with MACID 5: 8 inputs, 8 outputs

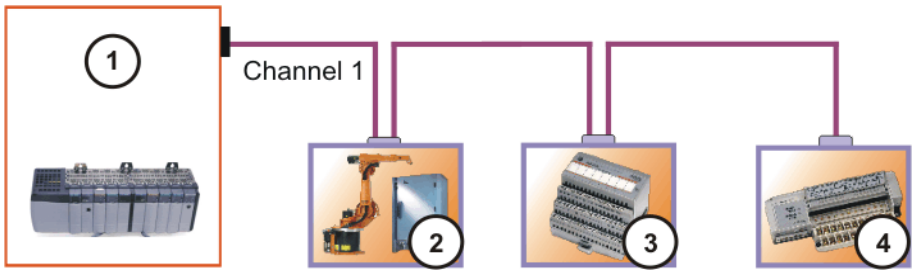


Fig. 7-2: Example: channel 1 as master and slave

1 PLC (master)
2 Robot controller (slave, master)
3 Flex I/O (slave)
4 Block I/O (slave)

DNSC_1SL.INI

```
[MODULE_STARTUP]
INACTIV=;
CONTINUE_WITH_WARNING=;
[SCANNERCFG]
NET_EPR=75
NET_ISD=2
NET_BACKGROUND_POLL_RATE=1
NET_TX_RETRY_COUNT=1

[1]
MAC_ID=1
VENDOR_ID=418
PRODUCT_TYP=12
PRODUCT_CODE=14
POLL_RESPL=4
POLL_CMDL=4
[2]
MAC_ID=5
VENDOR_ID=1
PRODUCT_TYP=7
PRODUCT_CODE=1102
POLL_RESPL=4
POLL_CMDL=2

[3]
MAC_ID=7
VENDOR_ID=1
PRODUCT_TYP=12
PRODUCT_CODE=1
POLL_RESPL=1
POLL_CMDL=1
```

DNSC_1CO.INI

```
[CONFIG]
MAC_ID=1
BAUDRATE=500
DEBUG=1

[FAST_OUT]
```

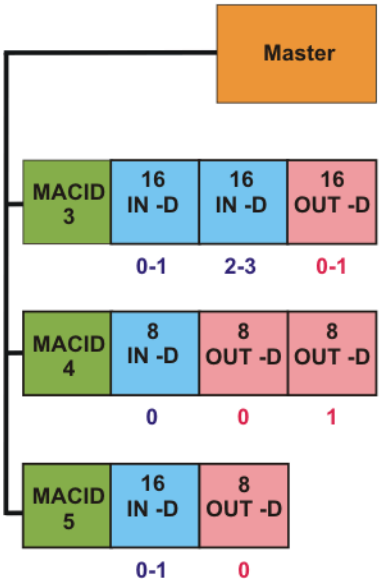
IOSYS.INI

```
[DNSC1]
;FLexI/O
INB0=7,0,x2 ;Statuswort
INB2=7,2,x2 ;$IN[17..32]
OUTB0=7,0,x2;$OUT[1..16]
;CompactblockI/O
INB4=5,0,x1    ;$IN[32..40]
OUTB2=5,0,x1   ;$OUT[17..24]
;from/to PLC
INB10=1,0,x4   ;$IN[41..72]
OUTB10=1,0,x4  ;$OUT[25..56]
```

7.3 Assigning digital inputs/outputs

Bus structure via MFC with:

- MFC as master
- Device 1: I/O module with MACID 3:
  16 digital inputs, 16 digital inputs, 16 digital outputs
- Device 2: I/O module with MACID 4:
  8 digital inputs, 8 digital outputs, 8 digital outputs
- Device 3: I/O module with MACID 5:
  16 digital inputs, 8 digital outputs




```
[DEVNET]
; Devicenet MACID 3
INW0=3,0,x1          ; $IN[1-16]
INB2=3,2,x2          ; $IN[17-32]
OUTW0=3,0,x1         ; $OUT[1-16]
; Devicenet MACID 4
INB4=4,0,x1          ; $IN[33-40]
OUTB2=4,0,x1         ; $OUT[17-24]
OUTB3=4,1,x1         ; $OUT[25-32]
; Devicenet MACID 5
INB5=5,0,x1          ; $IN[41-48]
INB6=5,1,x1          ; $IN[49-56]
OUTB4=5,0,x1         ; $OUT[33-40]
```

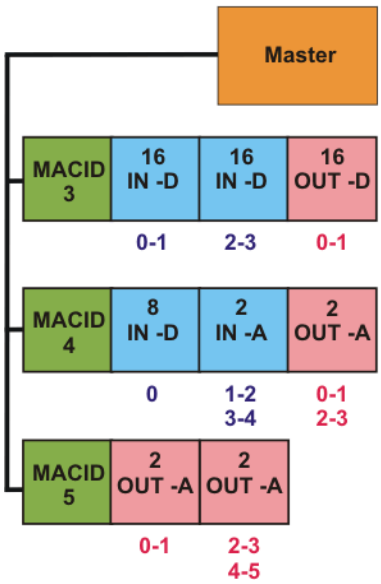
Fig. 7-3: IOSYS.INI – configuration example, digital

I/O sorting may be manufacturer-specific.

7.4 Assigning analog inputs/outputs

Bus structure via MFC with:

- Master module
- I/O module with MACID 3: 16 digital inputs, 16 digital inputs, 16 digital outputs
- I/O module with MACID 4: 8 digital inputs, 2 analog inputs, 2 analog outputs
- I/O module with MACID 5: 2 analog outputs, 2 analog outputs




```
[DEVNET]
; Devicenet MACID 3
INW0=3,0,x1                 ;$IN[1-16]
INB2=3,2,x2                 ;$IN[17-32]
OUTW0=3,0,x1                ;$OUT[1-16]
; Devicenet MACID 4
INB4=4,0,x1                 ;$IN[33-40]
ANIN1=4,1,16,3,CAL32768     ;ANIN[1]
ANIN2=4,3,16,3,CAL32768     ;ANIN[2]
ANOUT1=4,0,16,3,CAL32768    ;ANOUT[1]
ANOUT2=4,2,16,3,CAL32768    ;ANOUT[2]
; Devicenet MACID 5
OUTB2=5,0,x1                ;$OUT[17-24]
OUTB2=5,1,x1                ;$OUT[25-32]
ANOUT3=5,2,16,3,CAL32768    ;$NOUT[3]
ANOUT4=5,4,16,3,CAL32768    ;ANOUT[4]
```

Fig. 7-4: IOSYS.INI – configuration example, digital and analog

I/O sorting may be manufacturer-specific.

7.5 Generating a log file, MFC configuration

Procedure

1. Open the robot controller directory **C:\Program Files\KRC** or **C:\KRC\Roboter**.
2. Call **DEVNET.INI**.
3. Generate log file by means of entry **LOGFILE=1**.

```
[krc]
debug=1
baudrate=500
LOGFILE=1
```

4. Save changes.
5. Open log file via: **C:\KRC\ROBOTER\LOG\DEVNET.LOG**:

```
FILE_PTR_POS=000830
DN2Drv : Log Date 7.10.4 : 11:40
07/10/04 11:40:38 : Gen2 debugging enabled
07/10/04 11:40:39 : DN2DRV Version : 1.22.4.0
07/10/04 11:40:39 : baudrate 500 KBaud
07/10/04 11:40:39 : scan gap default is 6
07/10/04 11:40:40 : default priority is 173
07/10/04 11:40:40 : Power Off clear device data disabled
07/10/04 11:40:41 : scans 3 devices
07/10/04 11:40:41 : CAN1 base is 0d2000
07/10/04 11:40:47 : Driver is ready
=====  LAST_ENTRY  =====
```

Highlighted:

- 3 devices detected
- DeviceNet driver OK

No errors in the DeviceNet system.

8 Diagnosis

8.1 Error display

KUKA.HMI

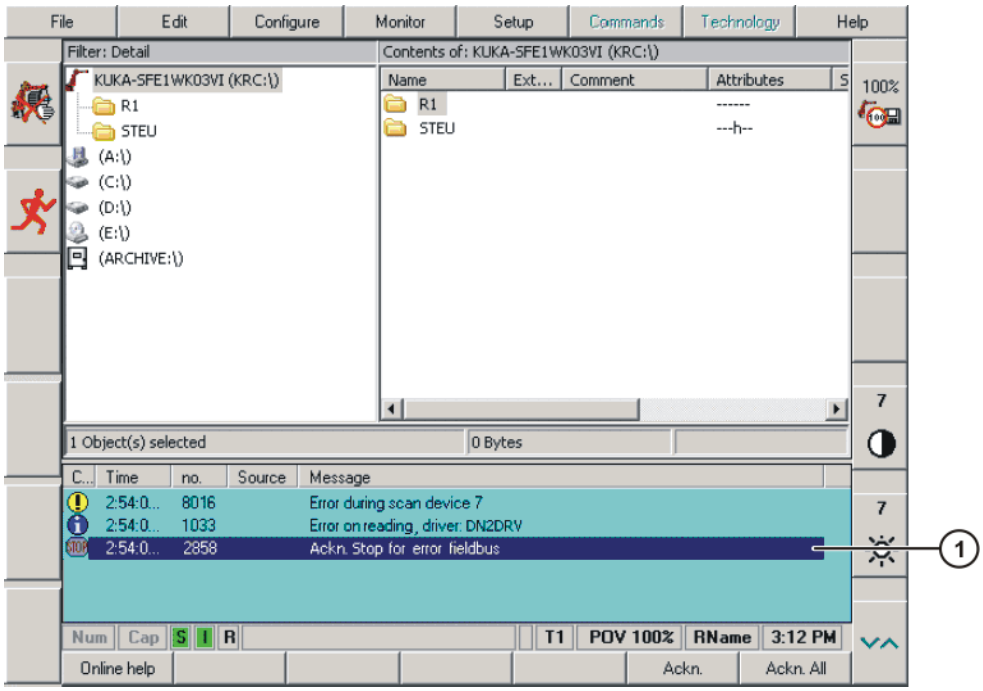


Fig. 8-1: Error display (1) Field bus error

Possible source of errors:

- Device error
- Error on reading or writing
- Driver error

Log file (MFC) C:\KRC\ROBOTER\LOG\DEVNET.LOG

```
FILE_PTR_POS=001073
DN2Drv : Log Date 7.10.4 : 11:48
07/10/04 11:48:49 : Gen2 debugging enabled
07/10/04 11:48:49 : DN2DRV Version : 1.22.4.0
07/10/04 11:48:50 : baudrate 500 KBaud
07/10/04 11:48:50 : scan gap default is 6
07/10/04 11:48:51 : default priority is 173
07/10/04 11:48:51 : Power Off clear device data disabled
07/10/04 11:48:51 : scans 3 devices
07/10/04 11:48:52 : CAN1 base is 0d2000
07/10/04 11:49:05 : ERROR CreateInstance failed !
07/10/04 11:49:06 : ERROR create instance failed
07/10/04 11:49:06 : ERROR [07] invalid IN-data
07/10/04 11:49:07 : ERROR [07] invalid OUT-data
=====  LAST_ENTRY  =====
```

Highlighted: write and read errors in device 7.

Log file (DeviceNet) **Error message in channel 1**

C:\KRC\ROBOTER\LOG\DNSC1.LOG

```
FILE_PTR_POS=001397
LPDN_Scanner : Log Date 07/09/05 : 15:20:38
07/09/05 : 15:20:38, DNch(1): >---------> Start LPDN-Scanner driver
(channel 1)
:
07/09/05 : 15:20:38, DNch(1): LPDN MAC_ID  :  1
07/09/05 : 15:36:43, DNch(1): Baudrate     : 500 KBaud
:
07/09/05 : 15:36:46, DNch(1): MAC_ID 03 projected
07/09/05 : 15:36:46, DNch(1): MAC_ID 04 projected
07/09/05 : 15:36:46, DNch(1): LPDN-Scanner state: running (channel 1)
07/09/05 : 15:36:56, DNch(1): Device[4]:Slave stopped communication
07/09/05 : 15:37:00, DNch(1): Device[4]: Device not responding
=====  LAST_ENTRY  =====
```

Highlighted: write and read errors in device 4.

Error message in channel 1 cleared

```
FILE_PTR_POS=001397
LPDN_Scanner : Log Date 07/09/05 : 15:20:38
07/09/05 : 15:20:38, DNch(1): >---------> Start LPDN-Scanner driver
(channel 1)
:
07/09/05 : 15:20:38, DNch(1): LPDN MAC_ID        :  1
07/09/05 : 15:36:43, DNch(1): Baudrate          : 500 KBaud
:
07/09/05 : 15:36:46, DNch(1): MAC_ID 03 projected
07/09/05 : 15:36:46, DNch(1): MAC_ID 04 projected
07/09/05 : 15:36:46, DNch(1): LPDN-Scanner state: running (channel 1)
07/09/05 : 15:36:56, DNch(1): Device[4]:Slave stopped communication
07/09/05 : 15:37:00, DNch(1): Device[4]: Device not responding
07/09/05 : 15:59:05, DNch(1): Device[4]: Error cleared: ('Slave
stopped communication')
=====  LAST_ENTRY  =====
```

Highlighted: device 4 active again.

LED indicators

The status of the card or network is indicated by means of bicolor LEDs (red/green). LEDs 1 and 2 are assigned to channel 1, LEDs 3 and 4 to channel 2.

I/O status (LEDs 1 and 3)

LED	Description
Off	In the “Reset” state or if no firmware is loaded on the card.
Off	All inputs and outputs are inactive.
Green	All configured inputs and outputs are active and error-free.
Flashing green	■ No inputs/outputs configured or active. ■ Inputs/outputs have errors.
Flashing red	One or more inputs/outputs cannot be read/written. Cause: incorrect configuration or faulty external device.
Red	Critical bus error

Module/network status (LEDs 2 and 4)

LED	Description
Red	The module is in the “Reset” state.
Off	Module ■ is not online ■ has not completed the Duplicate MacID test ■ has no mains voltage on the DeviceNet
Flashing green	The module is operating normally and is online, but no connections have been established to other devices. Cause: configuration is missing, incomplete or incorrect.
Flashing red	Recoverable error and/or one or more I/O connections are in “timeout” state.
Red	The module has an unrecoverable error: ■ there is another device with the same MacID on the bus ■ the bus is in the “Bus Off” state Open-circuit/short-circuit or incorrect baud rate setting on at least one device.
Flashing red and green	The module has detected a network access error and is in the “Communication error” state. The module has then received and accepted the communication error query message.

DeviceNet DIO1620, LED indicators

The status of the card or network is indicated by means of bicolor LEDs (red/green).

Module status

LED	Description
Off	The module has no mains voltage on the DeviceNet
Green	All configured inputs and outputs are active and error-free.
Flashing green	■ No inputs/outputs configured or active. ■ Inputs/outputs have errors.
Flashing red	Recoverable error, check supply voltage of the I/Os on the OMNI connector.
Red	Critical bus error

Network status

LED	Description
Off	The module has no mains voltage on the DeviceNet
Green	Module ■ functioning normally ■ is online ■ has one or more connections to other devices
Flashing green	The module is operating normally and is online, but no connections have been established to other devices.
Flashing red	Recoverable error and/or one or more I/O connections are in “timeout” state.

LED	Description
Red	The module has an unrecoverable error: ■ there is another device with the same MacID on the bus ■ the bus is in the “Bus Off” state Open-circuit/short-circuit or incorrect baud rate setting on at least one device.
Flashing red and green	The module is in the “Self-test” state.

8.2 Checking the hardware

In the event of malfunctions, check the following points first:

- Power supply present
- DIP switches set correctly
- A 121 Ω resistor must be connected to each end of the DeviceNet
  Exception: modules with hybrid Multibus cables
- Cable shield must be grounded once
- Negative supply voltage must be grounded
- Check the power consumption of the devices connected
- Check all the wires in the DeviceNet cable for continuity
- The resistance between the CAN high (white) and CAN low (blue) wires must be approx. 60 Ω
- If the cable is not connected, the resistance between the wires and the shield must be greater than 1 MΩ.

8.3 Telnet diagnosis, MFC card

Telnet commands can be used to define the overall status of the DeviceNet circuit and the module status of the individual DeviceNet devices.

Overview

Step	Description
1	Open Telnet (>>> 5.9.1 "Opening Telnet" page 33)
2	Poll devices (>>> 8.3.2 "Polling devices" page 49)
3	Read I/O device data (>>> 8.3.3 "Reading I/O data" page 49)

8.3.1 Opening Telnet

Procedure

1. Click on the Windows **Start** button.
2. Select the menu option **Run...**.
3. Enter the following in the **Open** box:
   - Windows 95: **Telnet 192.0.1.1**
   - Windows XP Security Patch 2 or higher: **Telnetk 192.0.1.1**
4. Click on **OK**.
   The Telnet window is opened.

In all Telnet entries: observe upper/lower case!

8.3.2 Polling devices

The Telnet command **dnWho** can be used to monitor which devices are connected to the DeviceNet.

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. Enter **dnWho**.
3. Press **Enter**.

Example

```
-> dnWho
DNDRV DNDRV starting WHO
DNDRV DNDRV using baudrate 500 KBaud
DNDRV [00]  is in scanlist
DNDRV [03]  is in scanlist
DNDRV [04]  is in scanlist
DNDRV [07]  is in scanlist
DNDRV [08]  is in scanlist
DNDRV searching devices...
DNDRV [03]  Group-2
DNDRV [04]  UCMM
DNDRV [07]  Group-2
DNDRV ready
value = 0 = 0x0
```

5 devices are detected in the scan list (DEVNET.INI) plus 3 external devices. Device [00] is always the master (MFC card).

8.3.3 Reading I/O data

The I/O data of the DeviceNet devices can be read using the Telnet command **dnShow 1**.

Precondition

- DeviceNet driver is activated in IOSYS.INI
- I/O module is listed in the scan list in DEVNET.INI
- Driver must be started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. Enter **dnShow 1**.
3. Press **Enter**.

Example

```
-> dnShow 1
DN2DRV Version : 1.22.4.0
Scanner enable : running
Scanner State  : OK
CAN Errors     : 0
CAN OverFlow   : 0
SystemTime     : 832483
BaudRate       : 500 KBaud
[00]  KRC      State 00  Master none
      Vendor   0000      ProdType 0000    ProdCode 0000
      Revision 0000      Produce  0000    Consume  0000
      SerNum   00000000  ProdName KUKA DN2-Driver
      I:
      O:
[03]  Warn 0   State 30:30  running online
      Vendor   0001      ProdType 0007    ProdCode 0137
      Revision 0301      Produce  0003    Consume  0003
      SerNum   0008ad09  ProdName 16 IN / 20 OUT, 24VDC
      I: 00 00 03
      O: 00 00 00
[04]  Warn 0   State 30:30  running online
      Vendor   0001      ProdType 0012    ProdCode 0001
      Revision 0102      Produce  0006    Consume  0004
      SerNum   00124dcf  ProdName 1794-ADN Flex I/O
      I: fc 00 00 00 00 00
      O: 00 00 00 0
[07]  Warn 0   State 30:30  running online
      Vendor   0108      ProdType 0012    ProdCode 5220
      Revision 0401      Produce  0002    Consume  0005
      SerNum   000a7d6b  ProdName BK5220 V01.04
      I: 00 00 03
      O: 00 00 00
value = 1 = 0x1
->
```

Entry	Description
[00]	MAC ID
Vendor	Manufacturer
ProdType	Module-specific data
ProdCode	Module-specific data
ProdName	Device name, device type
Produce	Number of input bytes
Consume	Number of output bytes

8.4 Telnet diagnosis

Telnet commands can be used to define the overall status of the DeviceNet circuit and the module status of the individual DeviceNet devices.

Overview

Step	Description
1	Open Telnet. (>>> 5.9.1 "Opening Telnet" page 33)
2	Poll device status. (>>> 8.4.2 "Polling the device status" page 51)
3	Poll DeviceNet status. (>>> 8.4.3 "Polling the DeviceNet status" page 51)
4	Read I/O device data. (>>> 8.4.4 "Reading I/O data" page 52)

8.4.1 Opening Telnet

Procedure

1. Click on the Windows **Start** button.
2. Select the menu option **Run...**.
3. Enter the following in the **Open** box:
   - Windows 95: **Telnet 192.0.1.1**
   - Windows XP Security Patch 2 or higher: **Telnetk 192.0.1.1**
4. Click on **OK**.
   The Telnet window is opened.

In all Telnet entries: observe upper/lower case!

8.4.2 Polling the device status

The module status of a DeviceNet device can be polled using the Telnet command **dnscxGetNodeInfo (MacID)** (x=channel number).

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. For channel 1: enter **dnsc1GetNodeInfo (MacID)**.
3. Press **Enter**.
4. For channel 2: enter **dnsc2GetNodeInfo (MacID)**.
5. Press **Enter**.

Example

Device [03] from the example **DeviceNet status** is called via MACID (3).

```
-> dnsc1GetNodeInfo 3
[3]     VendorID: 0001  ProdType: 0007  ProdCode: 0137
        Revision: 00.00 SerNum: <not available>
        /------ Produce Consume
        Poll:   0003    0003
        Strobe: 0000    0008
        COS:    0000    0000
        Cyclic: 0000    0000
        Name: <not available>
value = 23 = 0x17
->
```

Entry	Description
Poll	Number of bytes polled or written in poll mode
Produce	Inputs
Consume	Outputs

If there is no EDS file present, the module parameters required for configuration can be read here.

8.4.3 Polling the DeviceNet status

The DeviceNet status of a channel can be polled using the Telnet command **dnscxShow** (x=channel number).

Precondition

- DeviceNet driver is activated in IOSYS.INI

- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. For channel 1: enter **dnsc1Show**.
3. Press **Enter**.
4. For channel 2: enter **dnsc2Show**.
5. Press **Enter**.

Example

Channel 1 status called.

```
-> dnsc1Show
SW-ver. drv/fw/PLX   : 2.01/2.52/2
HW-ver. serial/board : 1292/0
MAC_ID               : 1
Baudrate             : 500 KBaud
DeviceState Ch 1     : Online
Nodes Active         : 3 4
Nodes Idle           : --
Nodes Fault          : --
Nodes State          : [03]=00 [04]=00
ScanFlags <0x0c>     : 'Interscan delay' + 'Send Strobe'
value = 1 = 0x1
->
```

Entry	Description
Nodes Active	Active modules, channel 1
Nodes State	Status of the active modules (value in hex)

8.4.4 Reading I/O data

The I/O data of a DeviceNet device can be read using the Telnet command **dnscxShowDevice** (x=channel number).

Precondition

- DeviceNet driver is activated in IOSYS.INI
- Driver is started (I/O reconfiguration)

Procedure

1. Open Telnet window.
2. For channel 1: enter **dnsc1ShowDevice** (**MacID**).
3. Press **Enter**.
4. For channel 2: enter **dnsc2ShowDevice** (**MacID**).
5. Press **Enter**.

Example

Call device with MACID 3 on channel 1.

```
-> dnsc1ShowDevice 3
[03] Poll   I:  00 00 03
            O:  00 00 00
value = 2 = 0x2
->
```

Entry	Description
I: 00 00 03	Input: 3 bytes, bit 0 and bit 1 = TRUE
O: 00 00 00	No outputs set

8.4.5 Status code

Code	Description
00	No error in module
46	Duplicate MACID test results received: MACID for this equipment is already assigned!
47	Incorrect entries in the scan list (files dnsc_1Sl.ini and/or dnsc_2Sl.ini)
48	Device stopped communication
49	Device does not correspond to configuration in the scan list
4a	DeviceNet port (interface at the bus) has detected data overflow
4b	Network communication failed
4c	Timeout due to missing communication
4d	Datawidth of the device does not match configuration
4e	Device not responding, bus interrupted, voltage supply missing or equipment defective
4f	Transmission error (DeviceNet card)
50	DeviceNet card is in idle mode
51	DeviceNet card is in the error state
52	I/O fragmentation incorrect (possible interference on the bus)
53	Device does not accept parameterization data from the master (incorrect configuration in the master)
54	Device not yet initialized
55	Too many data for fragmentation memory (possible interference on the bus)
56	Device is in idle mode
57	Assigned master cannot communicate with the device (bus interrupted, incorrectly configured to master, no supply voltage at the master, etc.)
58	Assigned master is not able to perform the parameterization
59	Configuration failed
5a	User has deactivated DeviceNet card
5b	“Bus Off” state detected (possible reflection/interference on the bus)
5c	No bus power supply at the device
60	DeviceNet card is in test mode
61	User has stopped DeviceNet card
62	Firmware error (incorrect firmware)
6f	Error occurred repeatedly (message appears along with another message)

9 KUKA Service

9.1 Requesting support

Introduction

The KUKA Robot Group documentation offers information on operation and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.

Faults leading to production downtime are to be reported to the local KUKA subsidiary within one hour of their occurrence.

Information

The following information is required for processing a support request:

- Model and serial number of the robot
- Model and serial number of the controller
- Model and serial number of the linear unit (if applicable)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software
- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

9.2 KUKA Customer Support

Availability

KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.

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