migra MPB CAN

Large Format Graphics Compatible LED Display with CANopen Interface

User's Manual

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1 General

The large format, graphics compatible display can be used universally for displaying production data, or as an information board.

The modular design allows for cost-effective variants in a variety of sizes, and with different character heights and numbers of digits.

Important information can be additionally highlighted in colour with the multicolour version (MC).

Display functions

- Data transmission: CANopen, RS 232 or RS 485 serial interfaces, USB or parallel interface
- Configuration by means of PC software (via serial interface)
- Texts (with various character sizes and fonts) and graphics can be displayed
- Stationary text, blinking text, moving screen text, scrolling and inverse display
- Monitor display, display of stored texts and graphics, variables display, execution of macros

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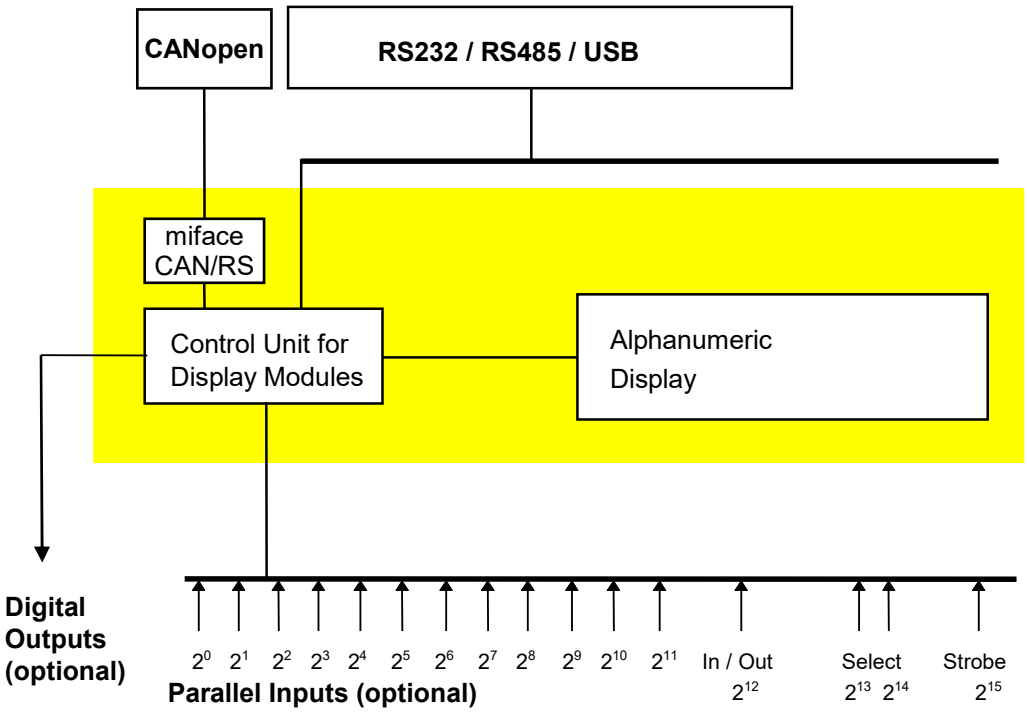
2 Overview



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3 Technical Data

3.1 General Specifications

Display type:	LED dot matrix display (max. 256x128(HxV))
Display:	ASCII characters (Windows character set), graphics
Display colour:	type SC: single colour, type MC: multicolour
View:	single or double sided
Operating voltage:	230 V / 50 Hz, 110 V / 60 Hz or 24 VDC +/-20 %
Interface:	CANopen, serial, parallel (optional)
Housing:	powder coated aluminium
Housing dimensions:	see chapter “device configuration”
Mounting:	articulated arm or hanging mount bracket for wall mounting
Protection:	IP 54 or IP 65
Operating temperature:	0 to +50° C (optional -20 to +50° C)
Storage temp.:	-25 to +70° C
Graphics:	max. 1000
Texts:	max. 1000 (max. 255 moving screen texts)
Variables:	max. 1000
character sets:	max. 100
Bar graphs:	max. 1000
Macros:	max. 1000

The available flash memory capacity for graphics, texts, variables, character sets and macros depends on the vertical resolution of the display:

- Vertical resolution ≤ 64 Pixel: 64 KByte
- Vertical resolution > 64 Pixel: 448 KByte

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3.2 Device Configuration

Itemnumber :_____

Number of pixels (horizontal x vertical): _____x_____

Type:
☐ for inside use ☐ for outside use

Display colour:
☐ red ☐ green ☐ yellow
☐ white ☐ blue

View:
☐ single sided ☐ double sided

Operating voltage:
☐ 230 V / 50 Hz ☐ 110 V / 60 Hz ☐ 24 V DC

Protection:
☐ IP40 ☐ IP54 ☐ IP65 ☐ IP _____

Operating temperature:

with type for inside use:	with type for outside use:	special version:
☐ 0...+50 °C (standard)	☐ -20...+50 °C (standard)	☐ _____ °C
	☐ -25...+50 °C (optional with heating)	

Housing dimensions:

_____x_____x_____mm

Housing Material:
☐ Aluminum profile ☐ Stainless steel ☐ Sheet metal

Interface:
☐ RS 232 ☐ RS485 ☐ USB
☐ parallel interface
☒ CANOpen

Default settings upon delivery:

RS baud rate: 19.2 kBaud
8 data bits, *1 stop bit*, *even parity*
Device address: 1

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3.3 Tips and Tricks

- When putting on the power supply, the following sequence has to be observed:
  - Connect the power supply cable to the display.
  - Connect the power supply cable to the power supply.

- When disconnecting the power supply, the following sequence has to be observed:
  - Disconnect the power supply cable from the power supply.
  - Disconnect the power supply cable from the display.

- Be sure to use a valid colour when creating texts.
  For example, green lettering may not be used with a red, single colour display (no display appears in this case).

- When selecting X and Y coordinates for the purpose of positioning, the desired position must actually exist at the display (resolution in pixels).

- Graphics, texts, variables and bar graphs to be displayed must fully fit into the display unit (otherwise they will not be displayed).
  “Underlengths” must also fit into the display for texts and variables.

- If you intend to operate the display via the serial interface, we recommend trying out the examples in chapter “Examples” first.

- If you intend to operate the display via the CANopen interface, we recommend reading chapter “CANopen Interface” first. This chapter includes examples which can be tried out immediately (see “Applications Examples”).

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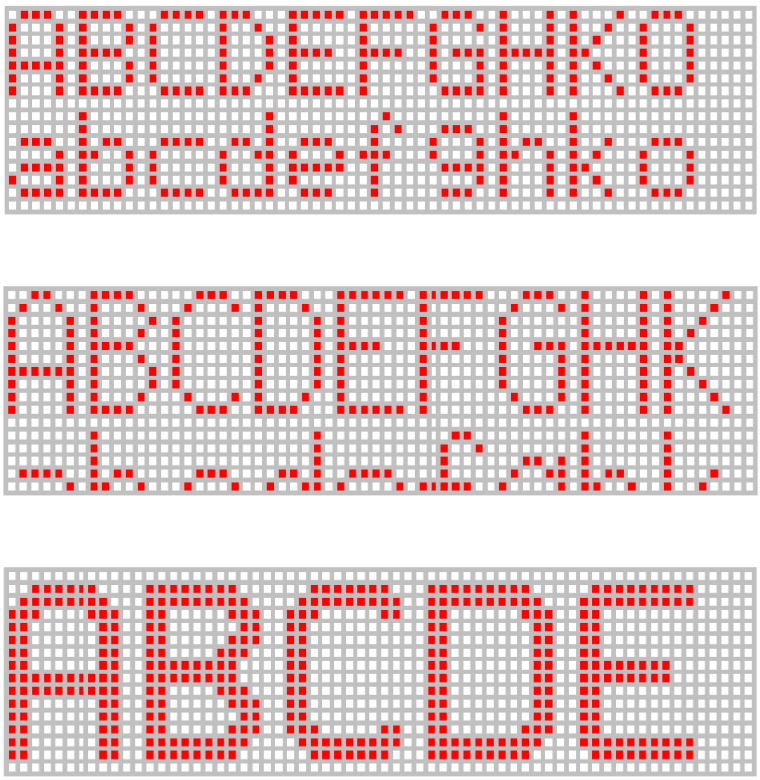
3.4 Display Elements

Alphanumeric display modules with 16 x 16, 64 x 8 or 64 x 16 dot matrices are utilized.

Attention: As far as the software is concerned, there is no difference between modules with 16 pixel lines and modules with 8 pixel lines. The last 8 lines are simply not visible at a module with 8 pixel lines.

The following example depicts a module with 64 x 16 pixels including three different character heights:



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3.5 System and Device Initialisation

Internal memory and functions tests are performed at the large format display during power-up (duration: less than 1 second).

If the display is not illuminated (and if the integrated function LED is slowly blinking, i.e. 0,5 Hz), the device is in boot mode. This indicates that the software currently stored on the integrated flash memory is incomplete. This may have been caused by a previously interrupted upload operation. If this is the case, uploading must be repeated (with the help of included PC software MKS).

A configuration message of the serial Interface appears on the display:

* Device address (ID)
* Baud rate
* Number of data bits.
* Type of parity bit
* Number of stop bits

After power-up, the first macro is executed (if one exists). If the display unit is to be cleared again immediately, a corresponding macro must exist
The display unit then waits for valid output data from the user (via one of the interfaces).

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3.6 Frame Layout

Frames transmitted to the large format display consist of 3 parts:

Header	Data Unit	Trail

Frames transmitted to the large format display are not evaluated by the device until 3 to 240 ms after the last frame byte has been received (receive timeout). The pause between the individual frame bytes may not exceed this time period!

The next frame can be transmitted immediately after the response frame has been received.

If no response frame is used, the large format display is not ready to receive a new frame until the last received frame has been completely processed. For example, if a large graphic is displayed, a longer waiting period is required than would be the case for reading out an “online character”. As a rule, a pause between frames amounting to “receive timeout plus 150 ms” is sufficient.

The above mentioned receive timeout (3 to 240 ms) also applies if several different MIGRAs (with different device addresses) are to be addressed one after the other at the same RS 485 bus.

In order to enable interaction between the PC software (MKS) and an RS 485 interface, a timeout period of at lest 30 ms must be selected as a rule.

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3.6.1 Header

STX	DA	SA	FC	LEN-H (optional)	LEN-L (optional)
Start of Text	Destination Address	Source Address	Frame Control	High Nibble Number of Data Bytes	Low Nibble Number of Data Bytes
00000010_b (02_h)	$1XXXXXXX_b$	$1XXXXXXX_b$	$1XXXXXXX_b$	$1111XXXX_b$	$1111XXXX_b$

STX: Start of text: 02_h

DA: Destination address:
Bit 7 must be set ⇒ possible addresses: 0 to 126_d, or 127_d for broadcast

SA: Source address:
Bit 7 must be set ⇒ possible addresses: 0 to 126_d

FC: Frame control: (control for the communications sequence)
Bit 7: set permanently to 1
Bits 6 - 2: reserved (0)
Bit 1: 0 -> do not use checksum
(do not use LEN-H/L, CHK-H/L)
1 -> use checksum
(use LEN-H/L, CHK-H/L)
Bit 0: 0 -> do not send response
1 -> send response

LEN-H: High nibble length: number of high nibble data bytes, bits 4 through 7 must be set
(e.g. number of data bytes = 26_h ⇒
high nibble = 2 ⇒ 11110010_b)

LEN-L: Low nibble length: number of low nibble data bytes, bits 4 through 7 must be set
(e.g. number of data bytes = 26_h ⇒
low nibble = 6 ⇒ 11110110_b)

LEN-H und LEN-L only need to be transmitted if a checksum is used. If bit 1 in the FC byte is not set, LEN-H and LEN-L may not be transmitted!

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3.6.2 Data-Unit

Data Unit
Display Data
$1B_h$, $0A_h$, $0D_h$, 20_h-FF_h

Data Unit: data bytes (ASCII characters, control commands)

3.6.3 Trail

If bit 1 is **not** set in the FC byte (do **not** use checksum):

ETX
End of Text
00000011_b (03_h)

End of Text: 03_h.

If bit 1 is set in the FC byte (use checksum):

CHK-H	**CHK-L**	**ETX**
High nibble from sum of all previous bytes (without STX)	Low nibble from sum of all previous bytes (without STX)	End of Text
$1111XXXX_b$ (FX_h)	$1111XXXX_b$ (FX_h)	00000011_b (03_h)

Checksum = low byte for sum of DA, SA, FC, LEN-H, LEN-L and all data bytes

CHK-H: High nibble for checksum: bits 3 through 0, bits 4 through 7 must be set (1).

CHK-L: Low nibble for checksum: bits 3 through 0, bits 4 through 7 must be set (1).

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3.7 Description of the Data Unit for Online Frames

The display must be configured with the PC software (micon 5) (define graphics, texts, variables, character sets, bar graphs and macros). The individual elements included in the configuration which has been downloaded to the display can then be used by the frames described in this chapter.

The display is delivered with a pre-programmed default configuration. However, you can create an individualised configuration for your own application and download it to the display unit with the PC software. The existing default configuration is overwritten in the process.

All indices are 0-based, i.e. “000” is transmitted in order to query the first text. The position 0 / 0 (X / Y) is the upper left-hand pixel at the display unit. All graphics, texts, variables and bar graphs are written to the display starting at the selected X and Y coordinates, and then proceeding down and to the right. The display’s physical limits may not be exceeded during this process (otherwise no display appears).

Note: 0-based indices are used in both PC software and for controlling for graphics, texts, variables , character sets and bar graphs!

Frames which contain no online text (ASCII codes 20_h through FF_h, $0A_h$, and $0D_h$), start with the escape character ($1B_h$) as the first data byte. A separate frame must be transmitted for each escape sequence.

If response frames are used, the next frame can be transmitted immediately after receipt of the response. However, this may lead to delays in the execution of macros, moving screen texts and scrolling if the frame sequence is too fast.

If response frames are not used, a pause must be inserted between the frames as described in chapter “Frame Layout”.

As a rule, data bytes included in the data unit must be ASCII coded!

Example: Specifying Position

... 31_h 32_h 33_h ... must be transmitted for position 123_d!
(ASCII characters “1”, “2” and “3”)

An ASCII table is included in chapter “Displayable Characters”.

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3.7.1 Online Texts

Online texts are transmitted without an escape sequence (ASCII codes 20_h - FF_h, $0A_h$ and $0D_h$).

Transmitted ASCII characters are displayed with the current character set at the current cursor position in consideration of current attributes.

Line breaks are executed by means of ASCII code $0A_h$ or $0D_h$, or by transmitting the escape sequence for setting cursor position (ESC “C”).

If the display limits are exceeded, read-out is continued at the next line, or at the first line of the display unit.

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3.7.1.1 Selecting a Character Set

Byte 1	Byte 2	Byte 3	Byte 4
ESC	Function	Character set no. tens	Character set no. ones
$1B_h$	"Z" ($5A_h$): normal character width "z" ($7A_h$): uniform character width	"0" - "9" (30_h-39_h)	"0" - "9" " (30_h-39_h)

Three character sets are included with the display unit upon delivery:

50 mm (1.97'') character set (character set "Z00", "z00")
75 mm (2.95'') character set (character set "Z01", "z01")
100 mm (3.94'') character set (character set "Z02", "z02").

Existing character sets are overwritten with the new character sets if a new configuration is downloaded to the display unit!

3.7.1.2 Positioning the Cursor

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
ESC	Function	X Position hundreds	X Position tens	X Position ones	Y Position hundreds	Y Position tens	Y Position ones
$1B_h$	"C" (43_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

3.7.1.3 Configuring Attributes

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
ESC	Function	Foreground colour	Background colour	Blinking
$1B_h$	"A" (41_h)	"0" (30_h): black "1" (31_h): green "2" (32_h): red "3" (33_h): yellow	"0" (30_h): black "1" (31_h): green "2" (32_h): red "3" (33_h): yellow "T" (54_h): transparent	"0" (30_h): static "1" (30_h): blinking

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3.7.2 Texts, Graphics, Variables and Bar Graphs

3.7.2.1 Displaying Graphics

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Display / clear	Graphic no. hundreds	Graphic no. tens	Graphic no. ones
$1B_h$	"G" (47_h)	"+" ($2B_h$): display "-" ($2D_h$): clear	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

When the display is cleared, the surface at which the graphic is displayed is overwritten with the current online background colour (from the last "ESC-A" frame)! Black is used if the background colour has been set to transparent!

3.7.2.2 Displaying Texts

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Display / clear	Text no. hundreds	Text no. tens	Text no. ones
$1B_h$	"T" (54_h)	"+" ($2B_h$): display "-" ($2D_h$): clear	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

When the display is cleared, the surface at which the text is displayed is overwritten with the current online background colour (from the last "ESC-A" frame)! Black is used if the background colour has been set to transparent!

3.7.2.3 Adjusting Speed for Moving Screen Texts

Byte 1	Byte 2	Byte 3
ESC	Function	Moving Screen Speed
$1B_h$	"L" ($4C_h$)	"0" (30_h): static "1" (31_h): 1.8 seconds … "9" (39_h): 0.2 seconds

All moving screen texts are set into motion at the selected speed. The default setting is "9" (0.2 seconds per step), and this setting is always activated each time the device is switched on.

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3.7.2.4 Displaying Variables

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Display / clear	Var. no. hundreds	Var. no. tens	Var. no. ones
$1B_h$	"V" (56_h)	"+" ($2B_h$): display "-" ($2D_h$): clear	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

When the display is cleared, the surface at which the variable is displayed is overwritten with the current online background colour (from the last "ESC-A" frame)! Black is used if the background colour has been set to transparent!

3.7.2.5 Setting Variables

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5.	Byte 6	Byte 7...133
ESC	Function	Set	Var. no. hundreds	Var. no. tens	Var. no. ones	Variable values
$1B_h$	"V" (56_h)	"=" ($3D_h$): set	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	(20_h-FF_h)

Variables may include up to 127 characters (the length of the variables is set during configuration).

The same number of characters are overwritten at the variable as are transmitted with the frame.

In order to avoid flickering, the old display is not cleared until after the new display is read out!

The background colour used for variables may not be transparent, and a character set with uniform character width should be used in order to assure correct display. Otherwise, the variable must be cleared prior to making a change, and then displayed once again!

Variable content is stored to RAM only. After the device has been switched off and back on again, the variables are returned to their pre-configured values.

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3.7.2.6 Increasing and Decreasing Variables

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Increase / decrease	Var. no. hundreds	Var. no. tens	Var. no. ones
$1B_h$	"V" (56_h)	"I" (49_h): increase or "D" (44_h): decrease	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Only numeric characters are changed. Letters, commas etc. are skipped. The numeric characters are interpreted as an single decimal number. This decimal number is increased or decreased by 1.

In order to avoid flickering, the old display is not cleared until after the new display is read out!

The background colour used with variables may not be transparent, and a character set with uniform character width should be used in order to assure correct display. Otherwise, the variable must be cleared prior to making a change, and then displayed once again!

Variable content is stored to RAM only. After the device has been switched off and back on again, the variables are returned to their pre-configured values.

3.7.2.7 Positioning Variables

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5.	Byte 6
ESC	Function	Set	Var. no. hundreds	Var. no. tens	Var. no. ones
$1B_h$	"V" (56_h)	"P" (50_h): set position	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12
X position hundreds	X position tens	X position ones	Y position hundreds	Y position tens	Y position ones
"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Variable positioning is stored to RAM only. After the device has been switched off and back on again, the variables are returned to their pre-configured positions.

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3.7.2.8 Querying Bargraphs

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Display / Clear	Bargraph-No. 100s	Bargraph-No. 10s	Bargraph-No. 1s
$1B_h$	„W“	„+“: display „-“: clear	„0“-„9“	„0“-„9“	„0“-„9“

Displaying a bargraph means to show the last sent value (which is equal to the reference value after RESET). If a variable is connected to the bargraph then it will be displayed, too.

Clearing a bargraph means to fill the bargraph area with the current online background colour (from the last „ESC-A“ frame). „Black“ is used if the online background colour has been set to „transparent“! If a variable is connected to the bargraph then it will be cleared, too.

At the moment no more than 255 bargraphs (numbers 0 to 254) are allowed.

Each connected variable may have a maximum number of 127 characters.

3.7.2.9 Setting Bargraphs

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
ESC	Function	Set	Bargraph-No. 100s	Bargraph-No. 10s	Bargraph-No. 1s	Kind of Data
$1B_h$	„W“	„=“: Set	„0“-„9“	„0“-„9“	„0“-„9“	„A“: ASCII--coded Decimal Value

Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13
Sign	Decimal Value 10000s	Decimal Value 1000s	Decimal Value 100s	Decimal Value 10s	Decimal Value 1s
„+“, „-“	„0“-„9“	„0“-„9“	„0“-„9“	„0“-„9“	„0“-„9“

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If the bargraph is not displayed yet then this will be done now.

The bargraph-bar will be displayed corresponding to its position between the MIN- and MAX-borders which are defined within the configuration data. The bar always starts at the configured reference value. It ends at the position of the current value.

At the position of the reference value the bar will be shown in its configured colour.

Passing one of the colour-borders (starting at the reference value) the bar will be shown in a new colour (defined with the border) after this point.

Four colour-borders are defined. Each one must be in the range „MIN-border ... MAX-border“:
MIN-border <= colour-border 1 <= colour-border 2 <= colour-border 3 <= colour-border 4 <=MAX-border

The PC-software ensures this rule !

Beside showing the bargraph as a multi-coloured bar (standard), it is also possible to show it as a single-coloured bar or as a single-coloured mark (depending on the configuration data - see PC-software).
The colour of the single-coloured bar / mark is the same as the colour of the end-position of the multi-coloured bar.

If the current value is not in the range „MIN-border ... MAX-border“ then a blinking mark will be shown at the MIN- or MAX-border.

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If a variable is linked to the bar graph, it is changed accordingly as well:

All digits occupied with the characters “#” and “*” are overwritten with the new value starting at the right.

If a variable is preset to “#”, preceding zeros are suppressed (i.e. replaced with blanks).

If a variable is preset to “*”, preceding zeros are displayed.

If a digit is occupied by the dollar sign ($), it is overwritten with the new preceding plus or minus sign.

Example:	Variable preset	= “$ #*,* m/s”
	Value	= -9 = “-00009”
	=> Display	= “- 0,9 m/s”

If minimum or maximum values are violated, the current values blinks at the display.

The background colour used for variables may not be transparent, and a character set with uniform character width should be used in order to assure correct display.

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3.7.3 Direct Graphic Control

3.7.3.1 Clearing and Filling the Display

Byte 1	Byte 2	Byte 3
ESC	Function	Colour
$1B_h$	„F“ (46_h)	“0” (30_h): black “1” (31_h): green “2” (32_h): red “3” (33_h): yellow

3.7.3.2 Setting the Decimal Point

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
ESC	Function	Colour	X pos. hundreds	X pos. tens	X pos. ones	Y pos. hundreds	Y pos. tens	Y pos. ones
$1B_h$	“P” (50_h)	“0” (30_h): black “1” (31_h): green “2” (32_h): red “3” (33_h): yellow	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)

3.7.3.3 Reading Out the Decimal Point from the Display

Query (FC byte, bit 0 = 1):

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
ESC	Function	Query code	X pos. hundreds	X pos. tens	X pos. ones	Y pos. hundreds	Y pos. tens	Y pos. ones
$1B_h$	“P” (50_h)	“?” ($3F_h$)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)

Response:

Colour information (with header and trail)

Byte 1	Byte 2	Byte 3
ESC	Function	Colour
$1B_h$	“P” (50_h)	“0” (30_h): black “1” (31_h): green “2” (32_h): red “3” (33_h): yellow

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3.7.3.4 Drawing a Rectangle

Byte 1	Byte 2	Byte 3	Byte 4
ESC	Function	Foreground colour (perimeter)	Background colour (filling)
$1B_h$	"R" (52_h)	"0" (30_h): black "1" (31_h): green "2" (32_h): red "3" (33_h): yellow	"0" (30_h): black "1" (31_h): green "2" (32_h): red "3" (33_h): yellow "T" (54h): transparent

Upper Left-Hand Corner Position:

Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10
X position hundreds	X position tens	X position ones	Y position hundreds	Y position tens	Y position ones
"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Lower Right-Hand Corner Position:

Byte 11	Byte 12	Byte 13	Byte 14	Byte 15	Byte 16
X position hundreds	X position tens	X position ones	Y position hundreds	Y position tens	Y position ones
"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

The perimeter of the rectangle is drawn with the foreground colour.
The rectangle is filled with the background colour.

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3.7.3.5 Scrolling

3.7.3.5.1 Displays with vertical Resolution < 64 Pixels

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
ESC	Function	Direction	Speed	Increment	Start line tens	Start line ones	End line tens	End line ones
$1B_h$	„S“	“0”: off “1”: up “2”: down	“0”: static “1”: 1.8 sec “9”: 0.2 sec	“1”: 1 pixel “9”: 9 pixels “0”: no scrolling	“0”-“9”	“0”-“9”	“0”-“9”	“0”-“9”

Scrolls once through a portion of the screen from the start line to the end line (speed = “static”) or cyclically in steps with a value ranging from 1 to 9 pixels.

The Y positions of the first and last pixel lines within the scrolling range define the start and end lines (end line > start line!). Only the last selected scrolling range is used!

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3.7.3.5.2 Displays with vertical Resolution > 64 Pixels

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
ESC	Function	Direction	Speed	Increment	Start line hundreds	Start line tens	Start line ones	End line hundreds	End line tens	End line ones
$1B_h$	„S“	“0”: off “1”: up “2”: down	“0”: static “1”: 1.8 sec “9”: 0.2 sec	“1”: 1 pixel “9”: 9 pixels “0”: no scrolling	“0”-“9”	“0”-“9”	“0”-“9”	“0”-“9”	“0”-“9”	“0”-“9”

Scrolls once through a portion of the screen from the start line to the end line (speed = “static”) or cyclically in steps with a value ranging from 1 to 9 pixels.
The y position of the first and last pixel lines within the scrolling range define the start and end lines (end line > start line!). Only the last selected scrolling range is used!

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3.7.4 General Functions

3.7.4.1 Selecting Blinking Period Duration

Byte 1	Byte 2	Byte 3
ESC	Function	Blinking period duration
$1B_h$	"B" (42_h)	"0" (30_h): 2 seconds : "9" (39_h): 0.2 seconds

The selected blinking period duration is assigned to all blinking texts.
A default value of 9 (0.2 seconds) is activated each time the device is switched on.

3.7.4.2 Adjusting Brightness

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ESC	Function	Colour	Brightness hundreds	Brightness tens	Brightness ones
$1B_h$	"H" (48_h)	"1" - "2" (31_h-32_h)	"0" - "1" (30_h-31_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Within a range of 0 to 100% for each of the following colours:
"1" = green
"2" = red

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3.7.5 Digital Inputs and Outputs

The large format display can be equipped with up to 16 digital inputs and 16 digital outputs (optional).

Query (FC-Byte, Bit 0 = 1):

Byte 1	Byte 2	Byte 3	Byte 2+n	Byte 18
ESC	Function	Output bit 1	Output bit n	Output Bit 16
$1B_h$	"D" (44_h)	"0" or "1" (30_h or 31_h)	"0" or "1" (30_h or 31_h)	"0" or "1" (30_h or 31_h)

"0" -> clear output
"1" -> set output
else -> retain previous output status

Response:

Byte 1	Byte 2	Byte 3	Byte 2+n	Byte 18
ESC	Function	Input bit 1	Input bit n	Input bit 16
$1B_h$	"D" (44_h)	"0" or "1" (30_h or 31_h)	"0" or "1" (30_h or 31_h)	"0" or "1" (30_h or 31_h)

"0" -> input cleared
"1" -> input set

The output bits are used to switch the digital outputs (if included in the hardware configuration).

After switching the device on, all outputs are cleared (0).

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3.7.6 Macros

Macros are predefined command sequences included in the device configuration. They correspond to the data units in the control frames.

The first macro is executed after the device is switched on (if one exists). Subsequent macros are executed every 100 ms. Macro execution is stopped after the last macro has been executed.

3.7.6.1 Starting Macro Execution

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
ESC	Function	Macro no. hundreds	Macro no. tens	Macro no. ones
$1B_h$	"M" ($4D_h$)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)	"0" - "9" (30_h-39_h)

Execution starts with the specified macro.

Jumps within a macro sequence are also possible during macro execution through the use of this command.

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3.7.6.2 Input Dependent Macro Jumps

Variant A:

Continues macro execution at the position with the designation “macro no.” (“000” - “999”), if the specified input (“0” - “F”) is set to “0” or “1”:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	
ESC	Function	Macro no. hundreds	Macro no. tens	Macro no. ones	“E” (fixed)	➔
$1B_h$	“M” ($4D_h$)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“E” (45_h)	

Byte 7	Byte 8	Byte 9
Number of the input to be queried (0 - 15)	“=” (fixed)	Queried status (0/1)
“0” - “F” (30_h-46_h)	“=” ($3D_h$)	“0” or “1” (30_h or 31_h)

Variant B:

Continues macro execution at the position with the designation “macro no.” (“000” - “999”), if the specified input (“0” - “F”) has been read in with a status of “0” or “1” at least once since the last query (with the “ESC-MXXXE...” command).
As a rule, the digital inputs are read in once every 100 ms.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	
ESC	Function	Macro no. hundreds	Macro no. tens	Macro no. ones	“E” (fixed)	➔
$1B_h$	“M” ($4D_h$)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“E” (45_h)	

Byte 7	Byte 8	Byte 9
Number of the input to be queried (0 - 15)	“#” (fixed)	Queried status (0/1)
“0” - “F” (30_h-46_h)	“#” (23_h)	“0” or “1” (30_h or 31_h)

Note:

If one of these commands (variant A or B) is executed from the macro list, the next macro is executed immediately (without waiting 100 ms and without once again reading in the digital inputs).
A pause of 100 ms is inserted no later than after 30 of these macros (“ESC-MXXXE...”) have been successively executed from the list, and the digital inputs are read in once again.

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Example:

	Macro No.	Macro Command
1	000	ESC-M005E0=1
2	001	ESC-M007E1#1
3	002	ESC-M009E2=1
4	003	ESC-w010
5	004	ESC-M000
6	005	ESC-T+000
7	006	ESC-M000
8	007	ESC-T+001
9	008	ESC-M000
10	009	ESC-F0
11	010	ESC-M000

* Inputs 0 through 2 are queried approximately once per second.

* Text “000” is displayed if input 0 is set.

* Text “001” is displayed if input 1 is set.
  This is also the case if the input was set only briefly (at least 100 ms), for example during the waiting period.

* The display is cleared if input 2 is set.

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3.7.6.3 Pause during Macro Execution

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
ESC	Function	Pause duration hundreds	Pause duration tens	Pause duration ones
$1B_h$	“w” (77_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)	“0” - “9” (30_h-39_h)

Sets the time which elapses until the next macro is executed (in steps of 100 ms).

A macro is normally executed every 100 ms until the last macro has been completed.

After the ESC + “w...” sequence, macro execution is stopped for the specified pause duration.

This sequence can be used as part of a macro, as well as part of a receive frame.

3.7.6.4 Stopping Macro Execution

Byte 1	Byte 2
ESC	Function
$1B_h$	“E” (45_h)

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3.8 Response Frames

A response frame is only transmitted if the corresponding bit (bit 0) was set in the FC byte, and if the broadcast address (127) has not been used as the destination address.

Example display address = 1,
master device address = 0

Response frame from the display to the master:

STX	DA	SA	FC	Data-Unit	ETX
Start of text	Destination address	Source address	Frame control	Error code	End of text
00000010_b	10000000_b	10000001_b	10000000_b		00000011_b
02_h	80_h	81_h	80_h	"0" - "5" (30_h-35_h)	03_h

Error Codes and their Meanings:

Value (ASCII character)	Meaning
"0" (30_h)	No error
"1" (31_h)	Incorrect checksum
"2" (32_h)	Reserved
"3" (33_h)	Incorrect number of data bytes (LEN-H/L), invalid escape sequence
"4" (34_h)	Element (text, variable, graphic, character set or macro) is missing, invalid parameter
"5" (35_h)	Invalid flash

The queried information is returned instead of error code "0" for frames which require a response (see also "Reading Out the Decimal Point from the Display" and "Digital Inputs and Outputs").

The error code in the response frame always relates to the last partition frame.

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3.9 Multiple ESC-Sequences

It is possible to combine several partition frames in one complete frame. This applies to the standard controlling and to the macro list.

The partition frames can be a ESC-sequence or a online text each.

If a online text shall follow after the ESC-sequence, it must be separated with the “separator sign“ $31_D = 1F_H$ from the ESC-sequence. The separator itself is not evaluated.

The maximum length of the data unit of a complete frame is 230 characters.

Example:

Data unit = $1B_H$ „Z01“ $1B_H$ „C002003“ $1B_H$ „A301“ $1F_H$ „online text“

=> An “online text” with character set 1, on cursor position x=2, y=3 with foreground colour „yellow“ and background colour „black“ is displayed (blinking).

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3.10 Examples

Read out online text to a large format display at address 1:

1. Without checksum, with response

STX	DA	SA	FC	Data Unit	ETX
Start of text	Destination address	Source address	Frame control	“Hello world”	End of text
00000010_b	10000001_b	10000000_b	10000001_b		00000011_b
02_h	81_h	80_h	81_h	...	03_h

Response from the large format display if no errors occur:

STX	DA	SA	FC	Data Unit	ETX
Start of text	Destination address	Source address	Frame control	Error code	End of text
00000010_b	10000000_b	10000001_b	10000000_b		00000011_b
02_h	80_h	81_h	80_h	“0” (30_h)	03_h

2. With checksum and response (in short form, HEX format)

The character “**A**” is to be displayed at the large format display at address 1:

Master: 02 81 80 83 F0 F1 **41** FA F6 03
Display: 02 80 81 80 30 03

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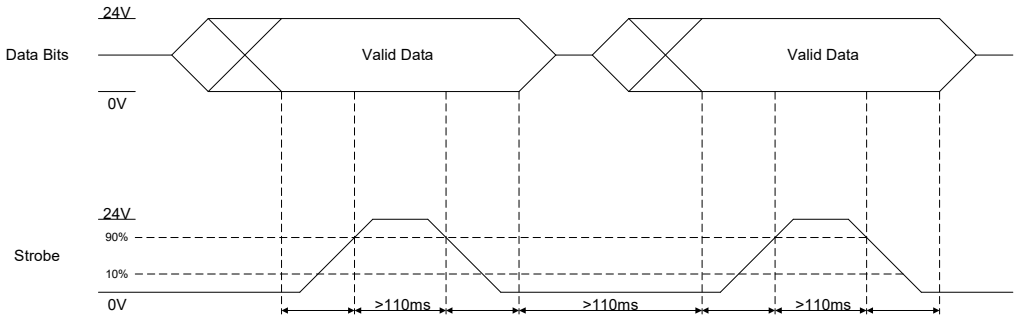
3.11 Parallel Interface

Functions can be initialised via the 16 digital inputs analogous to the online frames of the serial interface.

3.11.1 Timing at the Parallels Inputs



3.11.2 Input Level at the Parallel Inputs

Level	Voltage Range
U (low)	+ 0 to 1.6 V DC
U (high)	+ 18 to 30 V DC

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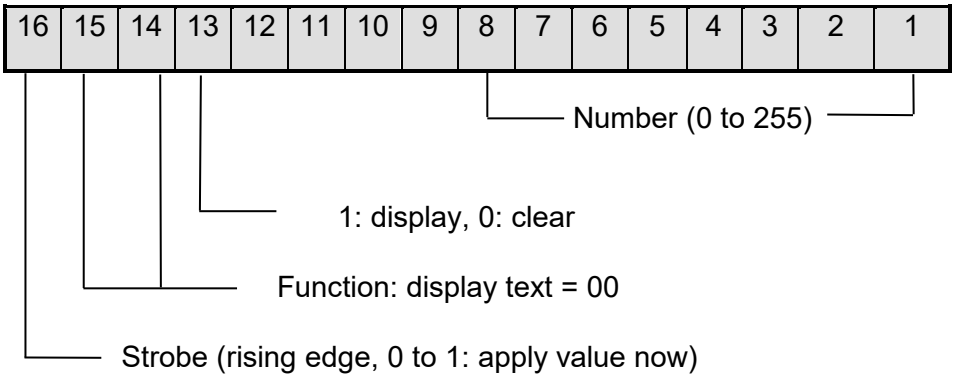
3.11.3 Displaying Texts



For example, the following assignments are used to display text 12:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0

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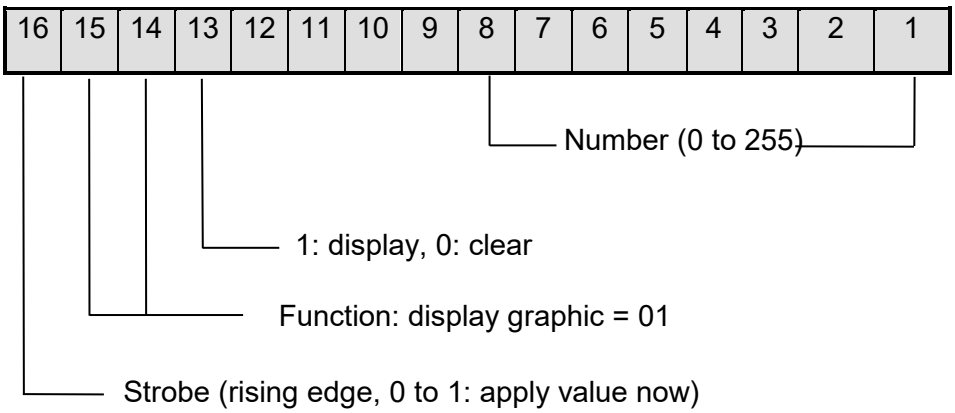
3.11.4 Displaying Graphics



For example, the following assignments are used to clear graphic 7:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1

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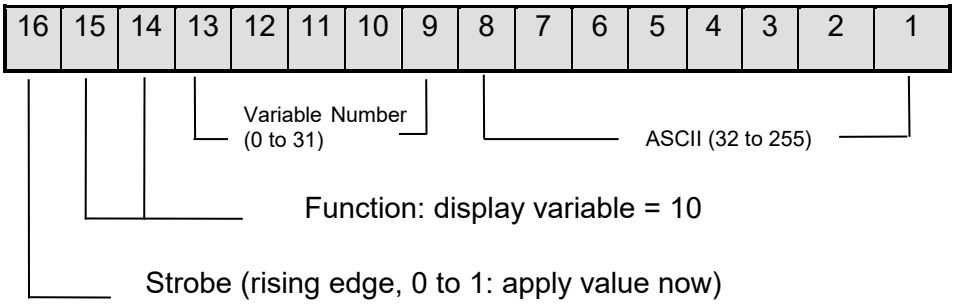
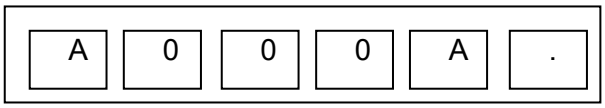
3.11.5 Setting Variables

Variables with a single character can be set directly:



Example: The variable at the fourth digit is to be changed at a display with 6 variables.



Each digit is implemented by means of a variable (numbers 0 through 5). In order to display a “9” at the fourth digit, ASCII value 39_h must be assigned to variable 3 (fourth digit). The inputs must be set up as follows to this end:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	1	0	0	0	0	1	1	0	0	1	1	1	0	0	1

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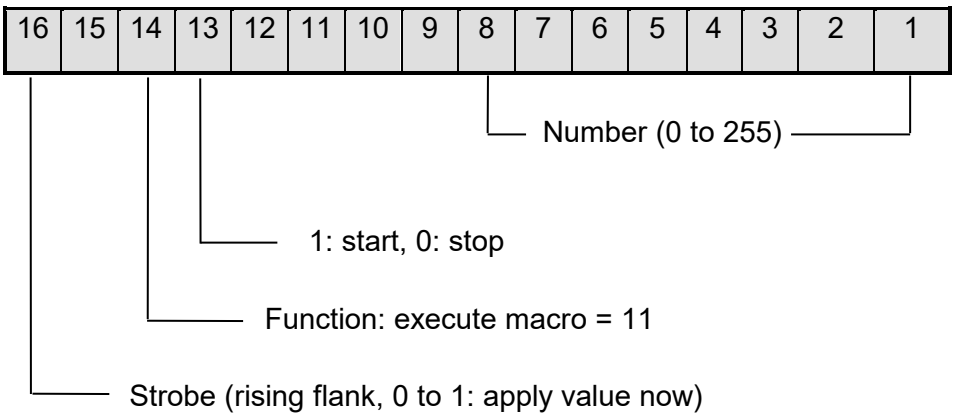
3.11.6 Executing Macros



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3.12 CANopen Interface

The **migra SC/MC 5/3 CANopen** is an expanded version of the **migra SC/MC 5/3 serial**.

The display unit can be controlled via either the serial interface or the CANopen interface.

The **miface CAN-RS** interface has been integrated into the display unit to this end. In this way, serial frames can be transmitted and received via the CANopen interface

The same frames are transmitted to the MIGRA display via the CANopen interface as is also the case with the serial interface.

The following settings (factory default settings) are mandatory for interaction between the MIGRA control PCB and the CANopen interface:

CANopen Interface:

RS (S2) DIP Switches	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Status (1=ON, 0=OFF)	0	0	1	1	0	0	0	0	0	0

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3.12.1 General

With the help of the universal interface, frames can be exchanged between the CANopen bus and a serial interface (RS 232 / 485 / 422). This allows for the connection of devices to the CANopen bus which are only equipped with a serial interface.

3.12.2 General Specifications

Interface 1:	CANopen per CIA standard DS301, V4.0
Bit rate:	10 to 1000 kBit/s (DIP switch)
Node ID:	1 to t127 (DIP switch)
PDOs:	1 receive PDO, 1 transmit PDO
PDO linking:	Yes (COB IDs for utilised PDOs can be adjusted via SDO)
PDO mapping:	Fixed
Node guarding:	Yes
Heartbeat:	Yes
Interface 2:	RS interface (permanently integrated into the MIGRA!)
Baud rate::	19.2 kBaud
Data width:	8 Bit
Parity:	even
Stop bits:	1
Max. frame length:	200 bytes in transmit direction 200 bytes in receive direction
Frame end detection:	By means of receive timeout

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3.12.3 CANopen Protocol

The interface is driven via the CANopen interface as defined in CIA DS301, V4.0 (CAN in Automation e.V., Erlangen, Germany).

The protocols integrated into the device are described briefly below.

3.12.3.1 NMT Frames

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
Start remote node	000 h	1	0 / node ID	-	-	-	-	-	-
Stop remote node	000 h	2	0 / node ID	-	-	-	-	-	-
Enter pre-operational state	000 h	128	0 / node ID	-	-	-	-	-	-
Reset node	000 h	129	0 / node ID	-	-	-	-	-	-
Reset communication	000 h	130	0 / node ID	-	-	-	-	-	-

All CANopen nodes are in one of the following operating states: initialisation, pre-operational, operational or stopped.

After power-up, the initialisation state is executed and entries in the object index are set to their default values.

Either all communications-specific entries, or only those included in the object index (1000 h -1FFF h), can be reset to their default values at any time with the help of the “reset node” and “reset communication” commands.

The device then enters the pre-operational state.

The device is switched to the operational state after issuing the “start remote node” command.

The device can be switched to the stopped state through use of the “stop remote node” command.

Return to the pre-operational state is made possible with the “enter pre-operational state” command.

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3.12.3.2 Nodeguard Frame

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
Receive	700 h + node ID RTR=1 DLC=1	-	-	-	-	-	-	-	-
Response	700 h + node ID RTR=0 DLC=1	128 x toggle bit (0 or 1) + current operating state: 4: STOPPED 5: OPERATIONAL 127: PRE-OPERATIONAL	-	-	-	-	-	-	-

The “nodeguard” frame may only be used when “heartbeat” is inactive (“producer heartbeat time” = object 1017 h = 0).

When “life-guarding” is activated (“guard time” = object 100C h > 0 and “life time factor” = object 100D h > 0), a timer is started each time a nodeguard request occurs, which automatically switches the device to the pre-operational state after “life time” has elapsed (“guard time” x “life time factor” ms), if the next nodeguard request is not received on time.

3.12.3.3 Heartbeat Frame

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
Response	700 h + node ID RTR=0 DLC=1	Current operating state: 0: BOOTUP 4: STOPPED 5: OPERATIONAL 127: PRE-OPERATIONAL	-	-	-	-	-	-	-

The “boot-up” frame is transmitted after the device is switched on (operating state = “BOOTUP”).

After selecting the setting “producer heartbeat time” = object 1017 h (unit of measure: ms), the device starts transmitting the heartbeat frame in a cyclical fashion.

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3.12.3.4 SDO Frames

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
"Initiate download request"	600 h+ node ID	22 h or 23 h + *	Index - LOW	Index - HIGH	Subindex	D0 (LSB)	D1	D2	D3 (MSB)
"Initiate download response"	580 h+ node ID	60 h	Index - LOW	Index - HIGH	Subindex	0	0	0	0
"Initiate upload request"	600 h+ node ID	40 h	Index - LOW	Index - HIGH	Subindex	0	0	0	0
"Initiate upload response"	580 h+ node ID	43 h+ *	Index - LOW	Index - HIGH	Subindex	D0 (LSB)	D1	D2	D3 (MSB)
"Abort domain transfer" (receive SDO)	600 h+ node ID	80 h	Index - LOW	Index - HIGH	Subindex	Additional code	0	Error code	Error class
"Abort domain transfer" (send SDO)	580 h+ node ID	80 h	Index - LOW	Index - HIGH	Subindex	Additional code	0	Error code	Error class

* 4 times "number of unused data bytes"

The object index of all CANopen nodes can be accessed with the help of the SDO frame.

3.12.3.5 Receive PDO Frame

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
RPDO1	200 h + node ID	RS send data 1	RS send data 2	RS send data 3	RS send data 4	RS send data 5	RS send data 6	RS send data 7	RS send data 8

RPDO1 is mapped to object 2000 h, subindex 1 through 8.

RPDO1 must be transmitted to the interface (repeatedly), in order to generate an RS send frame.

3.12.3.6 Transmit PDO Frame

	COB ID	B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8
TPDO1	180 h + node ID	RS receive data 1	RS receive data 2	RS receive data 3	RS receive data 4	RS receive data 5	RS receive data 6	RS receive data 7	RS receive data 8

TPDO1 is mapped to object 2001h, subindex 1 through 8.

TPDO1 is (repeatedly) transmitted from the interface after an RS frame has been received.

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3.12.4 Transmit RS Data Frame (CAN -> serial interface)

Receive PDO 1 (object 2000_h, subindex 1 through 8)

Byte	Function
1	Function byte: * Bit 7: end bit * Bits 6 … 5: reserved (=0) * Bit 4: toggle bit * Bit 3: reserved (=0) * Bits 2 ... 0: sub-frame length
2	Sub-frame byte 1
3	Sub-frame byte 2
4	Sub-frame byte 3
5	Sub-frame byte 4
6	Sub-frame byte 5
7	Sub-frame byte 6
8	Sub-frame byte 7

Toggle Bit:
Each time the toggle bit is changed, the current sub-frame is added to the end of the transmit buffer.

End Bit:

= 0: Sub-frames are accumulated.

= 1: Accumulated sub-frames are transmitted (including the sub-frame which has just been transferred if the toggle bit has also been changed).
The transmit buffer is cleared after transmission has been completed (in order to be able to store new sub-frames), and the end bit is set to 0 (in order to be able to detect the end of the transmit procedure via SDO).

Sub-Frame Length:
Length of the transferred RS sub-frame

Sub-Frame Bytes:
Are added to the end of the frame which has already been transferred to the transmit RS buffer when the toggle bit is changed.

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Procedure at the CANopen Side for Transmitting an RS Frame:

1. Break down the RS frame to be transmitted into sub-frames of max. 7 bytes each.

2. Transfer the sub-frames to the interface.

    * Prepare the contents of the PDO to be transmitted:

        * Enter frame bytes of the sub-frame to be transmitted to PDO bytes 2 through max. 8.

        * PDO byte 1:

            * Enter “sub-frame length” (1 to 7).

            * Change the “toggle bit”.

            * Set the “end bit” to 1, if no additional sub-frames need to be transmitted.

    * Transmit the PDO.

    * Wait until the PDO has been transmitted.

    * Wait an additional 5 ms (to allow the interface enough time to evaluate the PDO).

    * Repeat the last 4 steps until all sub-frames have been transferred.

3. Wait until the RS frame has been transmitted:

    * Transmission time depends upon frame length and the utilised RS baud rate:
        * = 1.3* x frame length x (10 x 1/baud rate) if no parity bit is used
        * = 1.3* x frame length x (11 x 1/baud rate) if a parity bit is used

      * A safety factor of 1.3 must be used because the individual frame bytes cannot be transmitted entirely without pauses (this becomes especially noticeable at higher baud rates between 38,400 and 115,200 baud).

    * Completion of frame transmission can also be detected by querying the “end bit” (via SDO). The end bit is changed to 0 as soon as the transmit buffer has been cleared, and the next frame can be transferred.

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Example: Transmitting an RS Frame
(transmit RS frame: “ABCDEFG12345”)

1. Break down the RS frame to be transmitted into sub-frames of max. 7 bytes each.

   * 1st sub-frame (7 bytes) = 41 h 42 h 43 h 44 h 45 h 46 h 47 h
   * 2nd sub-frame (5 bytes) = 31 h 32 h 33 h 34 h 35 h

2. Transfer the sub-frames to the interface.

   * Transmit PDO: 17 h 41 h 42 h 43 h 44 h 45 h 46 h 47 h
     (prerequisite: last toggle bit status = 0)
   * Wait until the PDO has been transmitted.
   * Wait an additional 5 ms (to allow the interface enough time to evaluate the PDO).
   * Transmit PDO: 85 h 31 h 32 h 33 h 34 h 35 h XX h XX h
   * Wait until the PDO has been transmitted.
   * Wait an additional 5 ms (to allow the interface enough time to evaluate the PDO).

3. Wait until the RS frame has been transmitted:

   * Example 19,200 baud, 8 data bits, even parity, 1 stop bit
     => Transmission time = 1.3 x 12 x (11 x 1/19,200) s = 9 ms
     => Wait at least an additional 9 ms (the function byte is not evaluated within this time period!)
   * Query the “end bit” via SDO:
     * Transmit CAN frame (COB ID = 600 h + node ID):
       40 h 00 h 20 h 01 h 00 h 00 h 00 h 00 h
     * Receive CAN frame (COB ID = 580 h + node ID):
       4F h 00 h 20 h 01 h “function byte” 00 h 00 h 00 h

     As soon as bit 7 (end bit) of the “function byte” is changed to 0, the next RS frame can be transferred to the interface.

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Important Notes:

* RS transmission operation is only possible in the CANopen “operational” state!

* After entering the operational state:

    * The transmit buffer is cleared (any previously accumulated sub-frames are deleted).

    * Any pending RS transmissions are completed first.

    * Object 2000$_h$, subindex 1 (function byte) is then deleted.
      => The toggle bit to be transmitted with the first sub-frame must be set to 1!

* The function byte is not evaluated during RS transmission. For this reason, it should not be changed until RS transmission has been completed.

* If the transmitted RS frame is longer than available RS transmit buffer capacity (200 bytes), a correspondingly truncated RS frame is transmitted!

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3.12.5 Receiving RS Frames (serial interface -> CAN)

Transmit PDO 1 (object 2001_h, subindex 1 through 8)

Byte	Function
1	Function byte: * Bit 7: end bit * Bits 6 … 5: reserved (=0) * Bit 4: toggle bit * Bit 3: reserved (=0) * Bits 2 ... 0: sub-frame length
2	Sub-frame byte 1
3	Sub-frame byte 2
4	Sub-frame byte 3
5	Sub-frame byte 4
6	Sub-frame byte 5
7	Sub-frame byte 6
8	Sub-frame byte 7

Toggle Bit:
Is changed each time a sub-frame is transferred.

End Bit:

= 0: Further sub-frames to follow

= 1: Last sub-frame

Sub-Frame Length:
Length of the currently transferred RS sub-frame

Sub-Frame Bytes:
Currently transferred RS sub-frame

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Interface Performance after Receiving an RS Frame:

1. Break down the RS frame into sub-frames of max. 7 bytes each.

2. Transfer the sub-frames.

    * Prepare the contents of the PDO to be transmitted:

        * Enter frame bytes of the sub-frame to be transmitted to PDO bytes 2 through max. 8.

        * PDO byte 1:

            * Enter “sub-frame length”
            (is always 7 unless the last sub-frame = 1 ... 7).

            * Change the “toggle bit”.

            * Set the “end bit” to 1, if no additional sub-frames need to be transmitted.

    * Wait until the selected inhibit time has elapsed (object 1800_h, subindex 3), if a PDO has been previously transmitted.

    * Transmit the PDO.

    * Repeat the last 3 steps until all sub-frames have been transferred.

3. Clear the RS receive buffer.

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Example: Receiving an RS Frame (“ABCDEFG12345”):

1. Break down the RS frame into sub-frames of max. 7 bytes each.

   * 1st sub-frame (7 bytes) = 41_h 42_h 43_h 44_h 45_h 46_h 47_h
   * 2nd sub-frame (5 bytes) = 31_h 32_h 33_h 34_h 35_h

2. Transfer the sub-frames.

   * Wait until the selected inhibit time has elapsed, if a PDO has been previously transmitted.

   * Transmit the PDO: 17_h 41_h 42_h 43_h 44_h 45_h 46_h 47_h (prerequisite: last toggle bit status = 0).

   * Wait until the selected inhibit time has elapsed.

   * Transmit the PDO: 85_h 31_h 32_h 33_h 34_h 35_h XX_h XX_h

3. Clear the RS receive buffer.

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Important Notes:

* RS receiving operation is only possible in the CANopen “operational” state!
* After entering the operational state:
    * The receive buffer is cleared.
    * Any previous data remaining in the receive buffer are deleted.
    * Object 2001$_h$ is deleted entirely (all bytes = 0).
      => The toggle bit of the sub-frame to be transferred with the first PDO is set to 1.
* The end of the RS receive frame is detected by means of the “receive timeout” (can be set with the DIP switch). In order to assure detection of the end of the frame, no characters may be received during the selected time period.
* RS receive frames may not exceed a length of 200 bytes.
* No further RS frames may arrive while the RS receive frame is being transmitted via the CANopen interface (these would otherwise be deleted).

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3.12.6 Applications Examples

1. Read out on-line text “Hallo Welt!” to the microSYST “MIGRA” display (without response frame):

MIGRA address = 01_h
CANopen node ID = 01_h

RS frame to be transmitted:
02_h 81_h 80_h 80_h 48_h 61_h $6C_h$ $6C_h$ $6F_h$ 20_h 57_h 65_h $6C_h$ 74_h 21_h 03_h

* Initialise the node (if it is not yet “operational”):
  Transmit NMT frame (COB ID = 000_h): 01_h 01_h

* Transmit RPDO1 frame (COB ID = 201_h):
  17_h 02_h 81_h 80_h 80_h 48_h 61_h $6C_h$ (last toggle bit status was 0)

* Wait at least 5 ms.

* Transmit RPDO1 frame (COB ID = 201_h):
  07_h $6C_h$ $6F_h$ 20_h 57_h 65_h $6C_h$ 74_h

* Wait at least 5 ms.

* Transmit RPDO1 frame (COB-ID = 201_h):
  92_h 21_h 03_h XX_h XX_h XX_h XX_h XX_h

* Wait at least 5 ms.

* Wait until transmission of the RS frame has been completed: At an RS baud rate of 19,200 with 8 data bits, even parity and und 1 stop bit, RS transmission has a duration of approximately
  1.3 x 16 x (11 x 1/19,200) s = 12 ms.

* Wait until the frame has been evaluated by the MIGRA display.

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2. Read out on-line text “Hallo Welt!” to the microSYST “MIGRA” display (with response frame):

MIGRA address = 01_h
CANopen node ID = 01_h

RS frame to be transmitted:
02_h 81_h 80_h 81_h 48_h 61_h $6C_h$ $6C_h$ $6F_h$ 20_h 57_h 65_h $6C_h$ 74_h 21_h 03_h

* Initialise the node (if it is not yet “operational”):
  Transmit NMT frame (COB ID = 000_h): 01_h 01_h

* Transmit RPDO1 frame (COB ID = 201_h):
  17_h 02_h 81_h 80_h 81_h 48_h 61_h $6C_h$ (last toggle bit status was 0)

* Wait at least 5 ms.

* Transmit RPDO1 frame (COB-ID = 201_h):
  07_h $6C_h$ $6F_h$ 20_h 57_h 65_h $6C_h$ 74_h

* Wait at least 5 ms.

* Transmit RPDO1 frame (COB-ID = 201_h):
  92_h 21_h 03_h XX_h XX_h XX_h XX_h XX_h

MIGRA response frame:
02_h 80_h 81_h 80_h 30_h 03_h

* Receive TPDO1 frame (COB ID = 181_h):
  96_h 02_h 80_h 81_h 80_h 30_h 03_h 00_h (last toggle bit status was 0)

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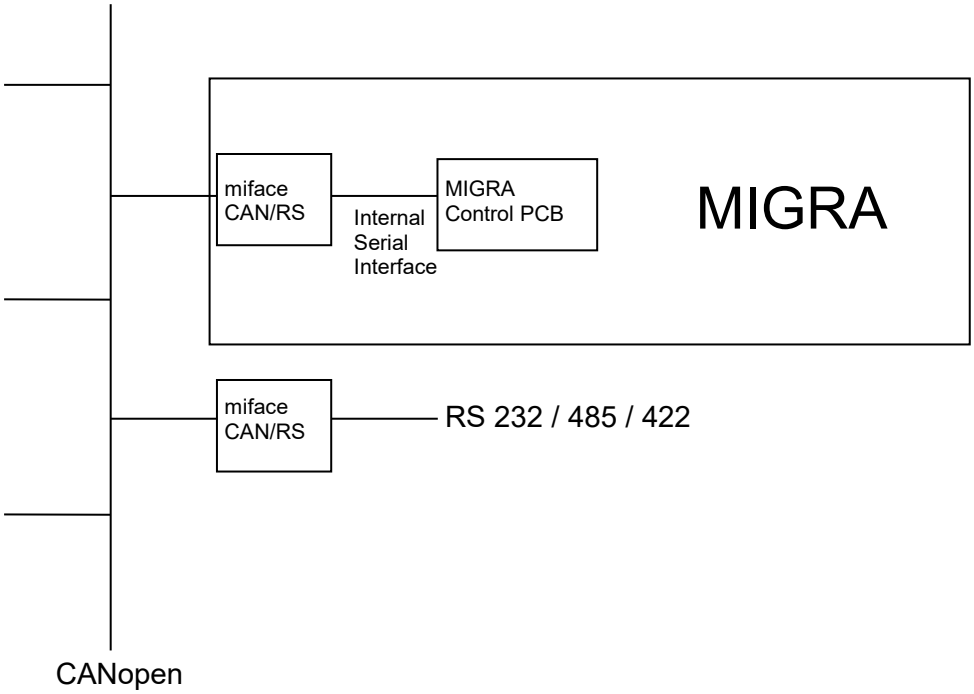
3. Connecting two serial interfaces via the CANopen bus



If CANopen communications need to be executed quasi “automatically”, the PDOs of both interfaces must be connected to each other (PDO linking).

Example:

Interface 1:
* Node ID = 1
* RPDO1 = 201 h (default value = 201 h)
* TPDO1 = 181 h (default value = 181 h)

Interface 2:
* Node ID = 2
* RPDO1 = 181 h (default value = 202 h)
* TPDO1 = 201 h (default value = 182 h)

After power-up, the COB IDs of both PDOs must therefore be set by interface 2 in this case:

* Transmit SDO frame (COB ID = 602 h): 22 h 00 h 14 h 01 h 81 h 01 h 00 h 00 h
* Wait for SDO response (COB ID = 582 h): 60 h 00 h 14 h 01 h 00 h 00 h 00 h 00 h

* Transmit SDO frame (COB ID = 602 h): 22 h 00 h 18 h 01 h 01 h 02 h 00 h 00 h
* Wait for SDO response (COB ID = 582 h): 60 h 00 h 18 h 01 h 00 h 00 h 00 h 00 h

* Initialise all nodes: transmit NMT frame (COB ID = 000 h): 01 h 00 h

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3.12.7 Important Notes

The device must be already connected to an active CAN bus at power-on! Otherwise a CAN error happens at sending the bootup message and it is not possible to change (immediately) to „OPERATIONAL“!

If it can not be assured that there exists at least one other active CAN bus member (f.e. the PLC) at power-on, then the following startup procedure for the CAN-device is recommended (example for node-ID=1):

a) Send "NMT, Start remote node":
TX: ID=000, LEN=2, RTR=0, DATA=01 01

b) Request the "Nodeguard Frame":
TX: ID=701, LEN=1, RTR=1
RX: ID=701, LEN=1, RTR=0, DATA=05/85 or 7F/FF

c) If DATA=7F/FF (=> still PRE-OPERATIONAL, red ERROR-LED is ON)
- Repeat step **b)** 40 times (=> red ERROR-LED goes OFF)
- Do step **a)** again (=> node starts successful now)

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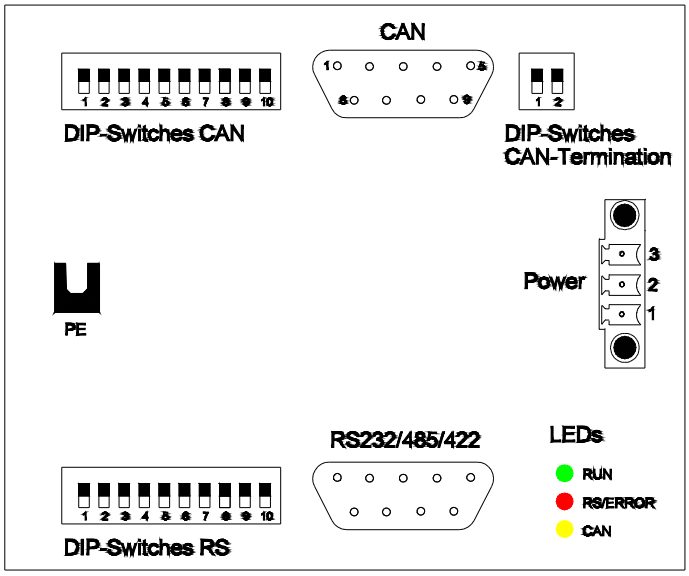
3.12.8 DIP Switches and LEDs



LEDs:

LED	State
RUN (green)	Normal operation: blinking
RS/ERROR (red)	RS communication: flickering Error: ON
CAN (yellow)	CAN frame received or transmitted => 100 ms ON

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DIP Switches

DIP switch settings are specified below (0 = OFF and 1 = ON).

DIP switch settings are read in once only during power-up (after switching the device on).

CAN Node ID:

CAN DIP Switches							CAN Node ID
DIP							
7	6	5	4	3	2	1	
0	0	0	0	0	0	1	1_d
0	0	0	0	0	1	0	2_d
0	0	0	0	0	1	1	3_d
:							:
1	1	1	1	1	1	1	127_d

Note: Only addresses 1 through 127 are permissible!

CAN Bit Rate:

CAN DIP Switches			CAN Bit Rate
DIP			
10	9	8	
0	0	0	1000 kBit/s
0	0	1	800 kBit/s
0	1	0	500 kBit/s
0	1	1	250 kBit/s
1	0	0	125 kBit/s
1	0	1	50 kBit/s
1	1	0	20 kBit/s
1	1	1	10 kBit/s

CAN Bus Termination:

CAN Termination DIP Switches		CAN Bus Termination
DIP		
1	2	
0	0	not terminated
1	1	terminated

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RS Baud Rate / Default Timeout:

RS DIP Switches DIP			RS Baud Rate (baud)	Default Timeout
3	**2**	**1**		
0	0	0	1200	28 ms
0	0	1	2400	14 ms
0	1	0	4800	7 ms
0	1	1	9600	4 ms
1*	0*	0*	19200	2 ms
1	0	1	38400	1 ms
1	1	0	57600	1 ms
1	1	1	115200	1 ms

* Setting required for communication with the MIGRA (do not adjust!)

Parity / Receive Timeout:

RS DIP Switches DIP			Parity	Receive Timeout
6	**5**	**4**		
0	0	0	none	default timeout
0*	0*	1*	even	default timeout
0	1	0	odd	default timeout
0	1	1	none	30 ms
1	0	0	none	3 x default timeout
1	0	1	even	3 x default timeout
1	1	0	odd	3 x default timeout
1	1	1	none	60 ms

* Setting required for communication with the MIGRA (do not adjust!)

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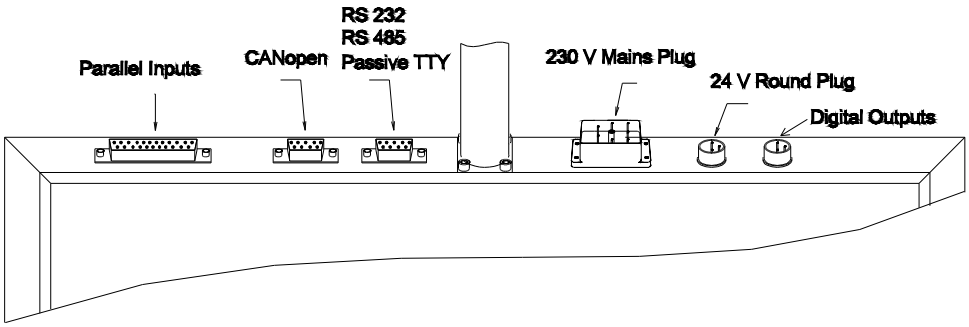
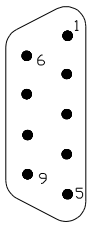
4 Connector Pin Assignments



9-Pin Sub-Miniature Plug Connector (CANopen)



Pin	CANopen
1	n.c.
2	CAN_L
3	CAN_GND
4	n.c.
5	n.c.
6	GND
7	CAN_H
8	n.c.
9	n.c.

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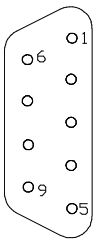
9-Pin Sub-Miniature Socket/Plug Connector (RS interface)

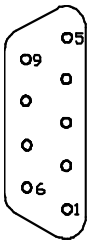
Depending upon the ordered RS interface type, one of the following pin assignment configuration applies:

RS 232 (plug connector)



Pin	RS 232
1	n.c.
2	RxD
3	TxD
4	n.c.
5	GND
6	n.c.
7	n.c.
8	n.c.
9	n.c.

RS 485 (socket connector)



Pin	RS 485
1	n.c.
2	n.c.
3	Rx+ / Tx+
4	n.c.
5	GND *
6	+5 VDC *
7	n.c.
8	Rx- / Tx-
9	n.c.

* If an external bus termination is needed, these pins can be used.

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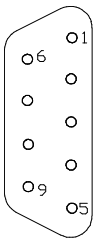
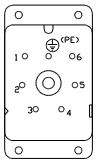
Passive TTY (plug connector)



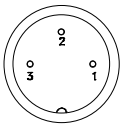
Pin	TTY
1	GND
2	n.c.
3	n.c.
4	n.c.
5	RxD +
6	TxD +
7	RxD -
8	TxD -
9	n.c.

7-Pin Mains Plug (230 VAC)



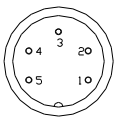
Pin	Assignment
1	L1
2	N
(PE)	PE

3-Pin Round Plug (24 V DC, optional)



Pin	Assignment
1	GND
2	+24 V DC
3	PE

5-Pin Round Plug (with optional digital outputs only)



Pin	Assignment
1	Relay 1, NO a
2	Relay 1, NO b
3	Relay 2, NO a
4	Relay 2, NO b
5	n.c.

Relays 1 and 2 are controlled by digital outputs 1 and 2 respectively (frame ESC+“D”).

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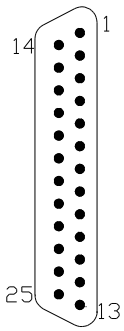
25-Pin Sub-Miniature Plug Connector (with optional parallel input only)



Pin 1	Binary data 2^0	
Pin 2	Binary data 2^1	
Pin 3	Binary data 2^2	
Pin 4	Binary data 2^3	
Pin 5	Binary data 2^4	
Pin 6	Binary data 2^5	
Pin 7	Binary data 2^6	
Pin 8	Binary data 2^7	
Pin 9		Variable no. 2^0
Pin 10		Variable no. 2^1
Pin 11		Variable no. 2^2
Pin 12		Variable no. 2^3
Pin 13	Display / clear (1: on, 0: off)	Variable no. 2^4
Pin 14	Function selection 2^0	
Pin 15	Function selection 2^1	
Pin 16	Strobe (1: apply value now)	
Pins 17 - 24	n.c.	
Pin 25	GND	

Binary data: Data with a value within a range of 0 to 255 as a text number, graphic number, macro number or as an ASCII character of a variable to be displayed.

Display / clear: Displays or clears the selected object from the screen.

Display text: Displays or clears the selected text from the screen.

Display graphic: Displays or clears the selected graphic from the screen.

Display variable: Displays the ASCII character configured by means of binary data at the position of the selected variable.

Execute macro: Starts / stops macro execution at the selected macro.

Strobe: Configured data are activated by applying a high level signal to pin 16 (> 110 ms). The command is executed no later than 100 ms after the rising edge, unless the display is still busy processing another command.

Details regarding the parallel inputs are included in chapter “Parallel Interface”.

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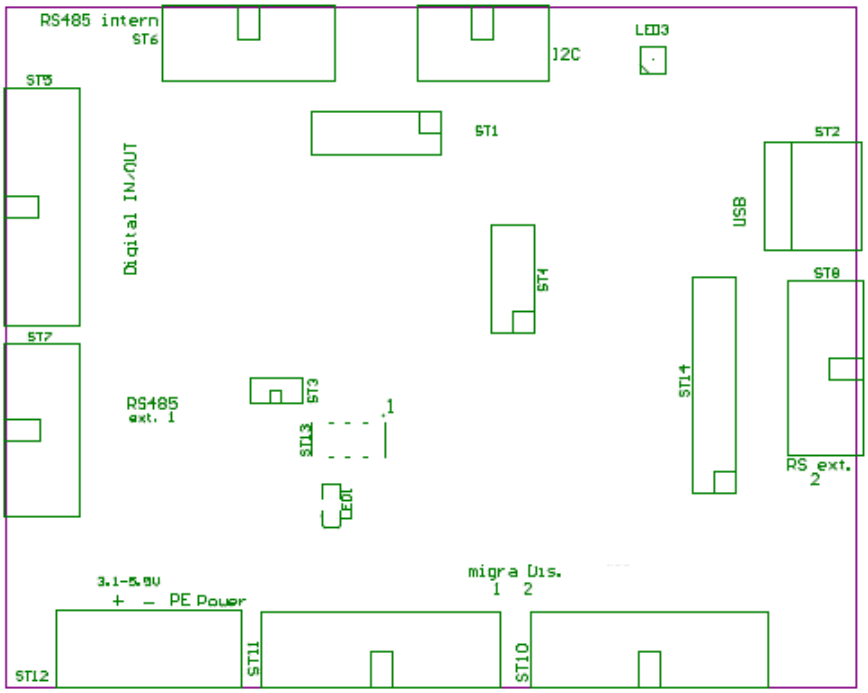
4.1 Interface Configuration / LEDs



The display unit is delivered with the following default settings:

*	Baud rate:	19200 baud
*	Data bits:	8
*	Parity:	even
*	Stop bits:	1.

For setting the serial interfaces the PC software MKS is mandatory.

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LED	Function / Description	
LED 1 (green)	Power-up: Normal operation: Boot mode: Software upload: Configuration: Defective MKS: Defective Micon:	Blinks at a frequency of approx. 2,5 Hz Blinks at a frequency of approx. 5 Hz Blinks at a frequency of approx. 0,5 Hz Flickers during the upload Blinks with an Error Code: 1x Blinks with an Error Code: 2x
LED 3 (blue)	Video-signal: No Video-signal:	On Off

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5 Appendix

5.1 Displayable Characters (ASCII table)

Data bytes are ASCII coded.
Character set: all ASCII characters within a range of 20H to FFH.

Sample character set:

Lower \ Higher	bin 0000 hex 0	0001 1	0010 2	0011 3	0100 4	0101 5	0110 6	0111 7	1000 8	1001 9	1010 A	1011 B	1100 C	1101 D	1110 E	1111 F
bin xxxx0000 hex 0	X	X		0	@	P	`	p	X	X	X	X	X	X	X	X
xxxx0001 1	X	X	!	1	A	Q	a	q	ü	X	X	X	X	X	X	X
xxxx0010 2	X	X	"	2	B	R	b	r	ß	X	X	X	X	X	X	X
xxxx0011 3	X	X	#	3	C	S	c	s	X	X	X	X	X	X	X	X
xxxx0100 4	X	X	$	4	D	T	d	t	ä	ö	X	X	Ä	X	ä	X
xxxx0101 5	X	X	%	5	E	U	e	u	X	X	X	X	X	X	X	X
xxxx0110 6	X	X	&	6	F	V	f	v	X	X	X	X	X	Ö	X	ö
xxxx0111 7	X	X	'	7	G	W	g	w	X	X	X	X	X	X	X	X
xxxx1000 8	X	X	(	8	H	X	h	x	X	X	X	X	X	X	X	X
xxxx1001 9	X	X	)	9	I	Y	i	y	X	Ö	X	X	X	X	X	X
xxxx1010 A	<CR>*	X	*	:	J	Z	j	z	X	Ü	X	X	X	X	X	X
xxxx1011 B	X	X	+	;	K	[	k	{	X	X	X	X	X	X	X	X
xxxx1100 C	X	X	,	<	L	\	l	|	X	X	X	X	X	Ü	X	ü
xxxx1101 D	<CR>*	X	-	=	M	]	m	}	X	X	X	X	X	X	X	X
xxxx1110 E	X	X	.	>	N	^	n	~	Ä	X	X	X	X	X	X	X
xxxx1111 F	X	X	/	?	O	_	o	▩	X	X	X	X	X	ß	X	X

X means not available

*Carriage Return: The cursor jumps to the beginning of the next line.

Any Windows character set or user-defined character set can be used.

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5.2 Maintenance and Care

Observe the following instructions in order to assure best possible performance of the display:

- Make sure that the housing can be opened for adjustment and maintenance even after the display has been installed. Allow for adequate clearance at the back, front and top of the display unit in order to assure sufficient ventilation (if vent slots are included).
- Display quality is impaired by direct illumination with bright light sources and/or direct sunlight.
- The display must be switched off before cleaning.
- Protect the LCD from excessive humidity, extreme vibration, direct sunlight and extreme temperatures. Non-observance may lead to malfunctioning or destruction of the device. Under certain circumstances electrical shock, fire and explosion may occur as well. Information concerning allowable ambient conditions, in particular regarding temperature and atmospheric humidity ranges, can be found in the chapter entitled “Technical Data”.
- The display may not be placed into service if the device and/or the power cable are known to be damaged.
- Do not attempt to open or repair the device yourself. The guarantee is rendered null and void if the device is tampered with by unauthorised persons.
- All instructions and stipulations included in this owner’s manual must be adhered to.

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5.3 Declaration of Conformity

EU-Konformitätserklärung

EU Declaration of Conformity

Produktbezeichnung: migra
Product name:

Typenreihe: migra CAN
Type code:

Hersteller: microSYST Systemelectronic GmbH
Manufacturer: Am Gewerbepark 11
92670 Windischeschenbach

Das bezeichnete Produkt stimmt mit der folgenden Europäischen Richtlinie überein: *We herewith confirm that the above mentioned product meets the requirements of the following standard:*		**Die Übereinstimmung des bezeichneten Produktes mit den Vorschriften der angewandten Richtlinie(n) wird nachgewiesen durch die Einhaltung folgender Normen / Vorschriften:** *The conformity of the product described above with the provisions of the applied Directive(s) is demonstrated by compliance with the following standards / regulations:*
Richtlinien / *Directives*		**Europäische Norm** / *Standard*
EMV Richtlinie *EMC Directive*	**2014/30/EU**	EN61000-6-2:2005
		EN61000-6-4:2007 +A1:2011
Niederspannungs-Richtlinie *Low Voltage Directive*	**2014/35/EU**	EN IEC 62368-1:2021-05
RoHS Richtlinie *RoHS Directive*	**2011/65/EU**	EN50581:2012

Windischeschenbach, 04.05.2021

Manuel Raß

Geschäftsführer / *General Manager*

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5.4 Warranty / Liability

For the product, liability is assumed for defects, which existed at the delivery date according to our General Terms and Conditions.

Technically changes as well as errors are excepted. A claim for delivery of a new product does not exist. The buyer has to check the received product immediately and indicate evident defects at the latest 24 hours after detection. Non-observance of notification requirements is equated with acceptance of the defect. Not immediately visible defects have to be indicated immediately after their perception too.

Generally, defects and their symptoms must be described as accurately as possible in order to allow for reproducibility and elimination. The buyer must provide for access to the relevant device and all required and/or useful information at no charge and must make all of the required data and machine time available free of charge.

The guarantee does not cover defects, which result from non-observance of the prescribed conditions of use, or from improper handling.

If the device has been placed at the disposal of the buyer for test purposes and has been purchased subsequent to such testing, both parties agree that the product is to be considered “used” and that it has been purchased “as is”. No guarantee claims may be made in such cases.

The General Terms and Conditions of microSYST Systemelectronic GmbH in current version apply as well.

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5.5 Versions Overview

Ver.	Date	Comments
1.00	18.04.02	Kreuzer, Nickl: created document
1.10	17.12.02	Kreuzer: New logo
1.20	23.01.03	Kreuzer: New designation Rx/Tx (+/-)
1.30	08.10.03	Kreuzer: New control unit
1.40	02.02.04	Kreuzer: Connector pin assignments changed (CAN without CAN_Shield)
1.50	31.01.05	Kreuzer: Text, graphics etc. are 0-based
1.60	07.03.06	Kreuzer: Maximum resolution is 4x12 display modules, several ESC sequences in a row are possible, signed integer coded decimal values at bargraphs removed, separator between several partition frames
1.70	16.08.10	Technical data updated
1.80	25.03.13	Company address, declaration of conformity, warranty
1.90	18.10.13	Logo
2.00	13.03.15	SC/MC removed, description of controller board
2.10	29.04.16	Declaration of conformity
3.00	24.11.16	migra ➔ migra MPB
3.10	13.11.17	Change of address and title MPB
3.20	18.04.18	Important notes to device startup
3.30	04.05.21	Declaration of conformity

Certified per **DIN EN ISO 9001**.

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