migra SC/MC 5/3

Large Format, Graphics Compatible Display with InterBus-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 models of various size, and with different character heights and numbers of digits.

Especially important information can be colour-highlighted with the multicolour model (MC).

1.1 Display Functions

- Data transmission: InterBus and RS 232-Interface
- Configuration with PC software (via serial port)
- Both texts (different font sizes and types) and graphics can be displayed
- Standard font, flashing font, moving screen text, scrolling, inverse display
- Display colours: red, green and mixing with yellow (with multicolour version)
- Monitor display, stored texts and graphics can be queried, variables can be displayed, execution of macros
- Variable size thanks to modular display design.

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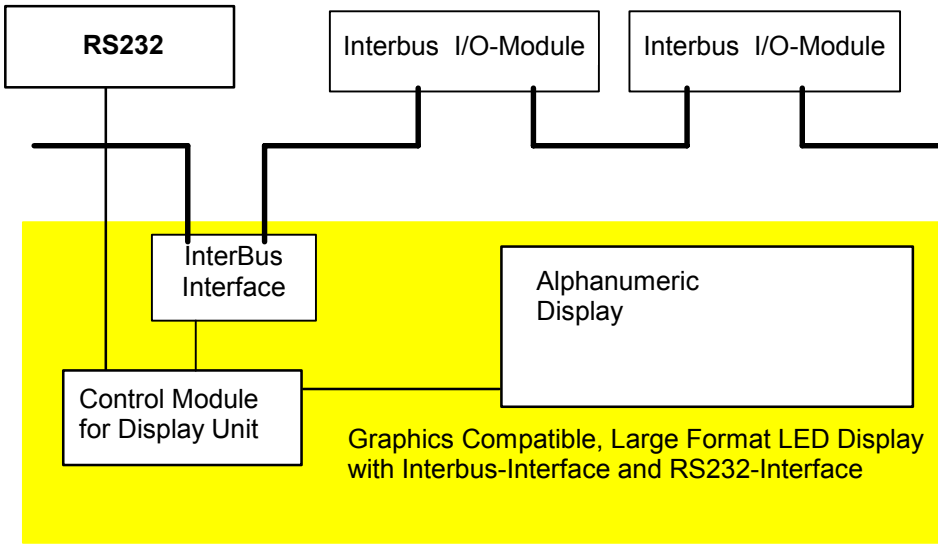
2 Application Example

Schematic diagram of the display unit at the interface:



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3 Technical Data

General Specifications

Display type:	LED dot matrix display
Pixel size:	5 / 3 mm (0.20'' / 0.12'')
Display:	ASCII character set (Windows character sets), graphics
Display colour:	single colour or multicolour: red, green, yellow
View:	single or double sided
Operating voltage:	230 V / 50 Hz, 110 V / 60 Hz or 24 VDC
Interface:	InterBus, serial
Housing:	powder coated aluminium
Housing dimensions:	see chapter 3.2 and 5
Mounting:	articulated arm or hanging mount bracket for wall mounting
Protection:	IP54 or IP65
Operating temp.:	0 to +50 °C (optionally -25 to +50 °C)
Storage temp.:	-25 to +70 °C
Graphics:	max. 1000
Texts:	max. 1000 (max. 255 moving screen texts)
Variables:	max. 1000
Macros:	max. 1000
Character sets:	max. 100

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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3.1 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.
  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 and variables to be displayed must properly fit into the display unit.

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3.2 Device Configuration

Number of pixels (horizontal x vertical): _____x_____

Display colour:
☐ red ☐ green ☐ yellow

View:
☐ single sided ☐ double sided

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

Protection:
☐ IP54 ☐ IP65

Temperature range:
☐ 0 to +50 °C ☐ -25 to +50 °C

Housing dimensions: _____x_____x_____mm

_____x_____x_____inches

Housing colour: RAL _____

Housing material:
☐ Aluminium profile
☐ Stainless steel
☐ Sheet metal

Interface:
☒ InterBus ☐ RS232 ☐ RS485

Default settings upon delivery:

InterBus ID: 03H

Device address (RS 232/485): _____ (decimal).

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3.3 Display Elements

Alphanumeric display modules with 64 x 8 or 64 x 16 dot matrices are utilized. Up to four modules can be stacked on top of one another, or mounted next to one another (without clearance gap).
→ Max. resolution: 256 (horizontal) x 64 (vertical) pixels.

Display type:	LED dot matrix display
Pixel height:	5 / 3 mm (0.20'' / 0.12'')
Pixel spacing:	7.62 / 4 mm (0.30'' / 0.16'')
Character height:	Depends upon selected Windows font (several fonts can be stored to the device with the help of the configuration software)
Number of lines:	Depends upon selected Windows font
Number of places:	Depends upon selected Windows font
Resolution per module:	64 x 8 pixels (8 pixel lines) or 64 x 16 pixels (16 pixel lines)
Display colour:	Single colour (SC) or multicolour: red, green and yellow (MC)
View:	Single sided or double sided
Display:	Any Windows character set (or user defined character set) and graphics
Dimensional display:	Upon request.

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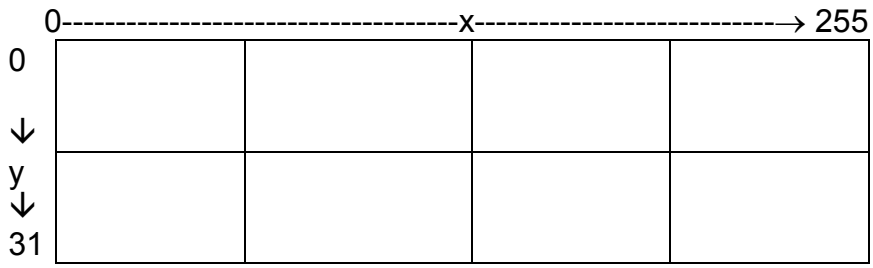
Horizontal resolution options (x axis):
64, 128, 192, 256 pixels

Vertical resolution options (y axis):
8 to 192 in steps of 8 pixels

Example: 4 x 2 modules (256 x 32 pixel):



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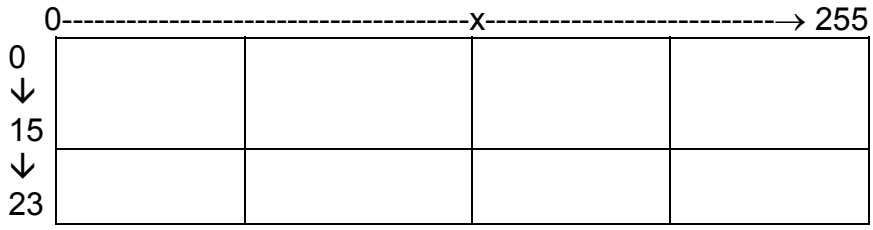
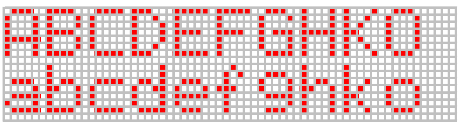
Whenever a module with 8 pixel lines is used, it is always positioned at the bottom of the stack.

Example: 4 x 2 modules (256 x 24 pixel)

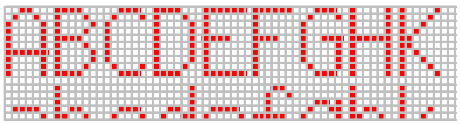


Attention: As far as the software is concerned, there is no difference between modules with 16 pixel lines and modules with 8 pixel lines. The last 8 lines are simply not visible at a module with 8 pixel lines.

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

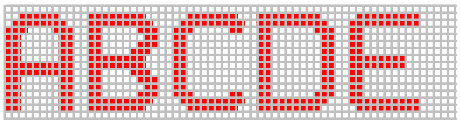


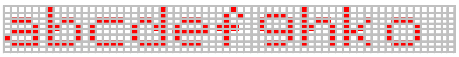
With a character height of 50 mm (1.97"), 2 lines and 10 characters per line are possible.



With a character height of 75 mm (2.95"), 1,5 lines and 9 characters per line are possible.

With a character height of 100 mm (3.94"), 1 line and 5 characters per line are possible.





A half module with a character height of 50 mm (1.97") allows for 1 line with 10 characters.

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3.4 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 functions LED blinks slowly, i.e. 1 Hz), the device is in the boot mode. This indicates that the software or the configuration data currently stored to the integrated flash memory are incomplete. This may result from a previously interrupted upload operation. If this is the case, uploading must be repeated (with the help of “MICON” PC software).

If the test mode has been activated (S 4), a series of checkerboard patterns is displayed in a cyclical fashion.

If the test mode has not been activated, the following parameters appear at the large format display, depending upon the HEX switch settings at the device:

- 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.

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3.5 Online Frame Layout

Each of the frames transmitted to the Large Format Display consist of 3 parts:

Header	Data Unit	Trail

Frames transmitted to the display are not evaluated by the device until 3 to 240 ms after the last frame byte has been received (depending upon baud rate and HEX switch settings). The pause between the individual frame bytes may not exceed this period of time! The pause between the individual frames must exceed this period of time!

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

If no response frame is used, the 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 of „receiving timeout“ + 150 ms between frames is sufficient.

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3.5.1 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	$1XXXXXXX_B$	$1XXXXXXX_B$	$1XXXXXXX_B$	$1111XXXX_B$	$1111XXXX_B$

STX: Start of text: 02_H

DA: Destination address:
Bit 7 must be set ⇒ possible addresses: 0 to 126_D, 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 (no response possible if controlled via InterBus).

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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3.5.2 Data Unit

Data Unit
Display Data
$1B_H$, $0A_H$, $0D_H$, 20_H - FF_H

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

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3.5.3 Trail

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

ETX
End of Text
00000011_B

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
$1111XXXX_B$	$1111XXXX_B$	00000011_B

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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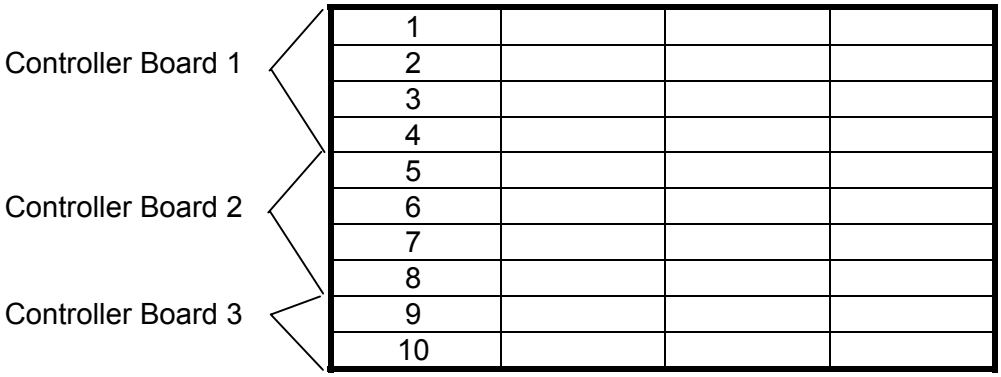
3.6 Displays with a Vertical Resolution > 64 Pixels

If a display has a vertical resolution of more than 64 pixels, two or three controller boards are integrated. Every controller board controls four module lines. For example, the first board controls the module lines 1 to 4.

Example: Large format display with a resolution of 4x10 display modules



3.6.1 General

- Scrolling ranges are divided in areas of four module lines each.
- The blinking period duration and the speed for moving screen texts must be set (or changed) either in the executed macro or with the frame without response.
- After power up, the display needs approx. 3 seconds more time (because of synchronization).
- At querying graphics, the coding of the graphic number can be three-digit or four-digit.

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3.6.2 Controlling

There are two possibilities to control the large format display:

1. The controller boards of the large format display are accessed separately (with two or three different addresses). Bit 0 of the Byte “FC” must be set (see chapter “Header”).

   Example: Querying graphics
   Transmit frame: 02 8**1** 80 8**1** 1B 47 2B 30 30 30 03
   Wait for response: 02 80 81 80 30 03
   Transmit frame: 02 8**2** 80 8**1** 1B 47 2B 30 30 30 03
   Wait for response: 02 80 82 80 30 03
   Transmit frame: 02 8**3** 80 8**1** 1B 47 2B 30 30 30 03
   Wait for response: 02 80 83 80 30 03

2. The large format display is accessed with one address. Bit 0 of the header byte “FC” must not be set (see chapter “Header”). Then, all controller boards evaluate the frame, not depending on the address. However, no response frame is transmitted to the master. Therefore, there must be taken a break after frame transmission (see chapter 3.5.

   Example: Querying graphics
   Transmit frame: 02 8**1** 80 8**0** 1B 47 2B 30 30 30 03
   Take a break: see chapter 3.5

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3.7 Description of the Data Unit for Online Frames

The display must be configured with the PC software (define character sets, graphics, texts, variables and macros). The individual elements included in the configuration which is uploaded 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 upload 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 variables, graphics and texts 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: All texts, graphics, variables, character set and bargraphs are 0-based (even in the PC software)!

Frames which contain no online text (ASCII codes 20_h through FF_h, 10_h and 13_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 to fast.

If response telegrams are not used, a pause must be inserted between the frames as described in chapter 3.5.

Data bytes included in the data unit must be in ASCII format!

Example, Specifying Position:

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

Refer to chapter 6.4 for a table of displayable ASCII characters!

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3.7.1 Online Texts

Online texts are transmitted without an escape sequence (ASCII codes 20_H - FF_H, $0A_H$, $0D_H$).

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

Line breaks are accomplished with the help 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.

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": normal character width "z": uniform character width	"0" – "9"	"0" – "9"

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 uploaded to the display unit!

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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”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”

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”	“0”: black “1”: green “2”: red “3”: yellow	“0”: black “1”: green “2”: red “3”: yellow “T”: transparent	“0”: static “1”: blinking

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3.7.2 Texts, Graphics, Variables and Bargraphs

3.7.2.1 Querying Text

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“	“+”: display “-”: clear	“0” – “9”	“0” – “9”	“0” – “9”

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!

3.7.2.2 Adjusting Speed for Moving Screen Texts

Byte 1	Byte 2	Byte 3
ESC	Function	Moving Screen Speed
$1B_h$	“L”	“0”: static “1”: 1.8 seconds : “9”: 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.

3.7.2.3 Querying 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”	“+”: display “-”: clear	“0” – “9”	“0” – “9”	“0” – “9”

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!

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3.7.2.4 Querying 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"	"+": display "-": clear	"0" – "9"	"0" – "9"	"0" – "9"

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 the 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"	"=": put	"0" – "9"	"0" – "9"	"0" – "9"	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 with the 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 the 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“	“I”: increase or “D”: decrease	“0” – “9”	“0” – “9”	“0” – “9”

Only numeric characters are changed. Letters, commas etc. are skipped. The numeric characters are interpreted as a 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 the 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 the 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 the 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”	“P”: set position	“0” – “9”	“0” – “9”	“0” – “9”

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”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”

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 Clear Display and Fill

Byte 1	Byte 2	Byte 3
ESC	Function	Colour
$1B_h$	“F”	“0”: black “1”: green “2”: red “3”: yellow

3.7.3.2 Setting the Point

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
ESC	Function	Colour	x pos. hun-dreds	x pos. tens	x pos. ones	y pos. hun-dreds	y pos. tens	y pos. ones
$1B_h$	„P“	“0”: black “1”: green “2”: red “3”: yellow	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”

3.7.3.3 Reading Out the Point from the Display

Query:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
ESC	Function	Query code	x pos. hun-dreds	x pos. tens	x pos. ones	y pos. hun-dreds	y pos. tens	y pos. ones
$1B_h$	“P”	“?”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”	“0” – “9”

Response:

Colour information (with header and trail)

Byte 1	Byte 2	Byte 3
ESC	Function	Colour
$1B_h$	“P”	“0”: black “1”: green “2”: red “3”: 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"	"0": black "1": green "2": red "3": yellow	"0": black "1": green "2": red "3": yellow "T": 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"	"0" – "9"	"0" – "9"	"0" – "9"	"0" – "9"	"0" – "9"

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"	"0" – "9"	"0" – "9"	"0" – "9"	"0" – "9"	"0" – "9"

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	ncrement	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	ncrement	Start line hun-dreds	Start line tens	Start line ones	End line hun-dreds	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!

The large format display is internally controlled with two or three controller boards. The limit is between line **63** and **64** and line **127** and **128**. If you specify a scrolling range which crosses this limit, two scrolling ranges are created.

Example
Scrolling range with start line = 50, end line = 80

➔ 1. scrolling range: line 50 to **63**
➔ 2. scrolling range: line **64** to 80

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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"	"0": 2 seconds : "9": 0.2 seconds

The selected blinking period duration is assigned to all blinking texts.
The default value ("9") 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"	"1" – "2"	"0" – "1"	"0" – "9"	"0" – "9"

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

The transmitted value is multiplied in accordance with the HEX switch settings at the device before it is applied.

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3.7.5 Macros

Macros are predefined command sequences included in the device configuration. They are analogous to the data units in the online 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.

3.7.5.1 Start 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“	“0” – “9”	“0” – “9”	“0” – “9”

Execution starts with the indicated macro.

Skipping is also possible during macro execution through the use of this command within a macro sequence.

3.7.5.2 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“	“0” – “9”	“0” – “9”	“0” – “9”

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 indicated pause duration.

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

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3.7.5.3 Stop Macro Execution

Byte 1	Byte 2
ESC	Function
$1B_h$	“E”

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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 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
2	128	129	128	“0” – “5”	3

Error Codes and their Meanings:

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

The queried information is returned instead of error code “0” for frames which require a response (“reading out decimal point from the display”).

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 the Display at address 1:

1. Without checksum, with response

STX	DA	SA	FC	Data-Unit	ETX
Start of text	Display address	Source address	Frame control	“Hello world”	End of text
00000010_B	10000001_B	10000000_B	10000001_B		00000011_B
2	129	128	129	...	3

Response from 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
2	128	129	128	“0”	3

2. With checksum and response (in short form)

The character “**A**” is to be displayed at the Display at address 1:

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

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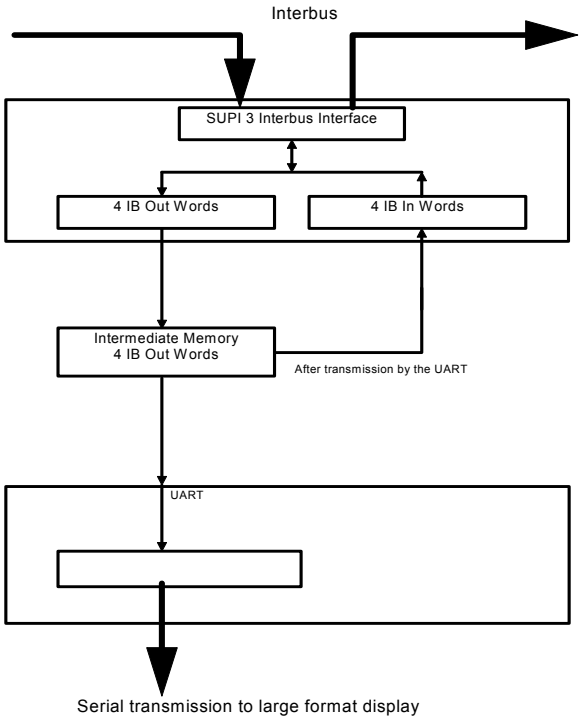
3.11 Control via the InterBus Interface

Data received by the InterBus („out“ words) are stored to intermediate memory, processed and transmitted to the large format display. After the frame has been transmitted, the frame data are mirrored via the InterBus as a response („in“ words).



3.11.1 User Data – IB Output

The large format alphanumeric display utilises 4 IB output words. These are used for transmission of user data which are required for control of the large format display. If data are available from the InterBus, these are stored to intermediate memory for further processing.

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3.11.2 User Data – IB Input

The large format alphanumeric display utilises 4 IB input words. These are used as a response to user data which have been transmitted to the large format display. After transmission of each frame, the IB data which have just been transferred to the large format LED display are mirrored in response to the „in“ words.

3.11.3 Toggle Byte

The interface at the large format display is driven with the first byte of output data.

The first byte of output data is saved to intermediate memory immediately after the InterBus interface has been initialised (first of all it must be „0“), and is then always compared with the respectively current content of the first byte of output data. As soon as the value of the first byte of output data is changed, subsequent output data are evaluated and interface data are transmitted to the large format display if appropriate. The only evaluation criterion is a change of content – the actual content itself is irrelevant.

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3.11.4 Interface Data

The large format display expects to receive interface data as of the 2nd byte of output data. These are transmitted after a change of content has occurred to the toggle byte.

3.11.5 Interbus Frame Layout for Display Control

Data structure at InterBus side (output: master to display)

1	2	3	4	5	6	7	8
Toggle byte	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7

Data structure at InterBus side (input: display to master)

1	2	3	4	5	6	7	8
Toggle byte	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7

The following must be observed in order to transmit a protocol to the large format display:

- The protocol at the large format LED display is subdivided into blocks of 7 bytes each, which are transmitted one after the other.
- The InterBus interface accepts output data transmitted by the IB master (7 bytes) as soon as the toggle byte has been changed. As soon as transmission of the 7 bytes of frame data to the large format display is concluded, the output data transmitted by the IB master are mirrored to the input data at the IB master (8 bytes).
- The next block cannot be transmitted until input and output data are identical (the comparison of the toggle byte is sufficiently).
- If the last block of the protocol requires less than 7 bytes, the unused bytes must be set to 00h (they are not sent).
- The pause between the transmission of individual data blocks within a given frame must be less than 30 ms!

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Example: **Display the word “TEST” as online text at the large format display with address no. 1**

Transmission of block 1

1	2	3	4	5	6	7	8
Toggle byte	02_H	81_H	80_H	80_H	“T”	“E”	“S”

First change bytes 2 through 8, then change byte 1!

Do not begin with transmission of block 2 until response has been received (8 bytes of output data are mirrored to the input data)!

Transmission of block 2

1	2	3	4	5	6	7	8
Toggle byte	“T”	03_H	00_H	00_H	00_H	00_H	00_H

First change bytes 2 through 8, then change byte 1!

The togglebyte of the current block must be changed at the latest 30 ms after the togglebyte of the prior block (otherwise the display would recognize the single blocks not as a related telegram).

After an entire frame has been transmitted, a waiting period of at least 200 ms must be observed before the next frame can be transmitted!

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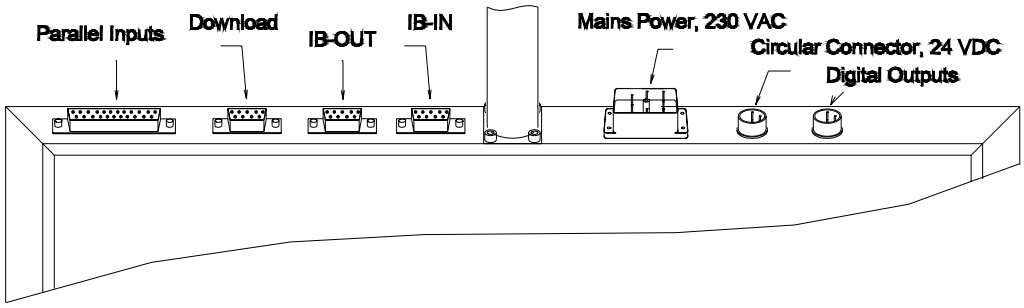
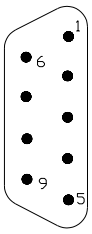
4 Connector Pin Assignments



9-Pin Sub-Miniature Plug Connector (Download)

According to the ordering option, the download happens via a RS232- or a RS485 interface.



Pin	RS 232	RS485
1	n.c.	n.c.
2	RxD	n.c.
3	TxD	Rx+ / Tx+
4	n.c.	n.c.
5	GND	GND *
6	n.c.	5VDC *
7	n.c.	n.c.
8	n.c.	Rx- / Tx-
9	n.c.	n.c.

* If an external bus termination is needed, these pins can be used.
The bus termination can also be set internally, when required (see chapter “Internal Switches”).The bus termination may be set only either internally or externally.

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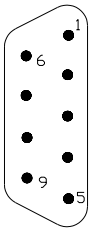
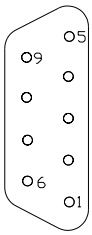
9-Pin Sub-Miniature Plug Connector (InterBus-Interface)



Pin	IB-IN
1	DO
2	DI
3	COM
4	n.c.
5	n.c.
6	/DO (inverted)
7	/DI (inverted)
8	n.c.
9	n.c.

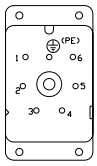
9-Pin Sub-Miniature Female Connector (InterBus-Interface)



Pin	IB-OUT
1	DO
2	DI
3	COM
4	n.c.
5	Termination* (+ 5 VDC)
6	/DO (inverted)
7	/DI (inverted)
8	n.c.
9	Termination* (RBST)

Termination*:
If a further device is connected, pin 5 must be bridged to pin 9.
If no further device is connected, pin 5 is not bridged to pin 9.

7-Pole Mains Plug (230 VAC)



PIN	Assignment
1	L1
2	N
(PE)	PE

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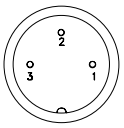
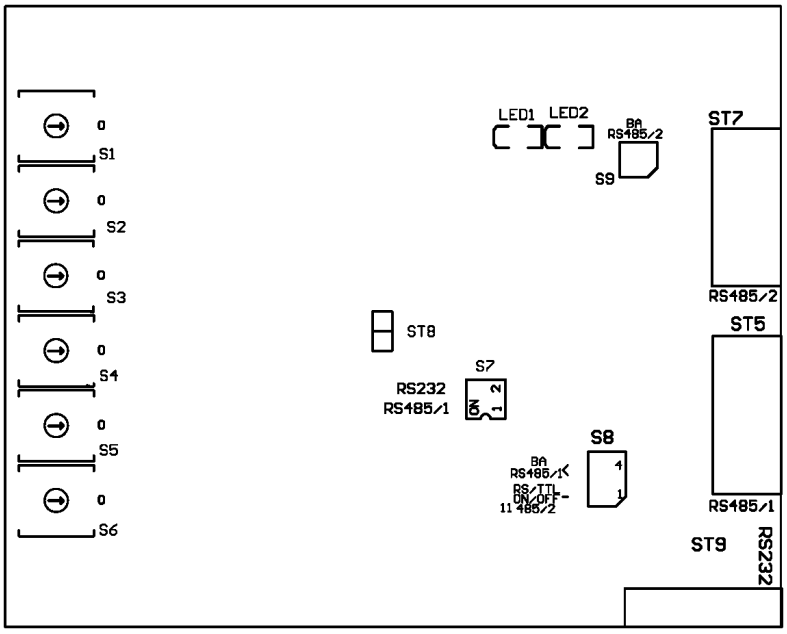
3-Pin Circular Plug (24 VDC)



PIN	Assignment
1	GND
2	+ 24 VDC
3	PE

4.1 Internal Switches

The housing must be opened in order to change switch settings.



The display unit is delivered with the following default settings:

- Baud rate: 19,200 baud
- Data bits: 8
- Parity: even
- Stop bits: 1.

If you change the default settings you also have to change the settings of the InterBus interface.

The device must be reset if these parameters are changed!
(Switch the device off and back on again.)

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	S1	S2	S3	S4	S5	S6
General description	Address low nibble	Address high nibble	Baud rate and data format	Test mode / receiving time-out	Brightness setting “green”	Brightness setting “red”
Switch setting ‘0’	0	+0	19,200 baud, 8 data bits, even parity	Off / 30 ms	Minimum	Minimum
Switch setting ‘1’	1	+16	1200 baud, 8 data bits, no parity	Off / 60 ms	16%	16%
Switch setting ‘2’	2	+32	1200 baud, 8 data bits, odd parity	Off / 90 ms	22%	22%
Switch setting ‘3’	3	+48	1200 baud, 8 data bits, even parity	Off / 120 ms	28%	28%
Switch setting ‘4’	4	+64	2400 baud, 8 data bits, no parity	Off / 150 ms	34%	34%
Switch setting ‘5’	5	+80	2400 baud, 8 data bits, odd parity	Off / 180 ms	40%	40%
Switch setting ‘6’	6	+96	2400 baud, 8 data bits, even parity	Off / 210 ms	46%	46%
Switch setting ‘7’	7	+112	4800 baud, 8 data bits, no parity	Off / 240 ms	52%	52%
Switch setting ‘8’	8	not defined	4800 baud, 8 data bits, odd parity	Standard Test / -	58%	58%
Switch setting ‘9’	9	not defined	4800 baud, 8 data bits, even parity	Standard Test / -	64%	64%
Switch setting ‘A’	10	not defined	9600 baud, 8 data bits, no parity	Standard Test / -	70%	70%
Switch setting ‘B’	11	not defined	9600 baud, 8 data bits, odd parity	Standard Test / -	76%	76%
Switch setting ‘C’	12	not defined	9600 baud, 8 data bits, even parity	Standard Test / -	82%	82%
Switch setting ‘D’	13	not defined	19,200 baud, 8 data bits, no parity	Standard Test / -	88%	88%
Switch setting ‘E’	14	not defined	19,200 baud, 8 data bits, odd parity	light sensor test-mode *2 / -	94%	94%
Switch setting ‘F’	15	not defined	19,200 baud, 8 data bits, even parity	Off / 3...30 ms *1	Maximum	Maximum

Allowable device addresses: 1 through 126.

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Receiving timeout:

= earliest possible point in time at which the display transmits a response after receiving a frame.

Between the individual telegram bytes may not pass any more than the oriented time (receiving timeout).

The next frame may be sent first after the current frame was worked off completely.
Therefore you must either keep a sufficient break (depending on the type of frame) or wait for the response frame.

*1) Receiving timeout = 3...30 ms
>= 3 x “byte time” (1 “byte time” = transmission time for a single byte)

➔ makes a faster frame sequence possible
➔ However, does not function with RS 485 and Windows PC software (because timing for RTS direction changes are inaccurate due to Windows limitations).

*2) To adjust the light sensor (if existing).
Shows the control value of the light sensor for the display brightness (in percent).

This value is in the range of 20 % (at absolute darkness) to 100 % (at the adjusted environment brightness).

The light sensor is mounted in the display housing directly behind the filter pane. By variation of the light sensor potentiometer you can influence the brightness control:

Most left position:	High environment brightness necessary to obtain a control value of 100 %.
Most right position:	Low environment brightness necessary to obtain a control value of 100 %.

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Bus termination (only at download via RS485 interface)

The bus termination can be set internally with the help of DIP switches.
In this case no external bus termination must be set.
Therefore the following DIP switches must be set to “ON”:

- S8: DIP3, DIP4
- S9: DIP1, DIP2

4.2 LEDs

Component	Function / Description	
LED 1	Power-up: Normal operation: Boot mode: Defective software:	Illuminated Blinks at a frequency of approx. 5 Hz Blinks at a frequency of approx. 1 Hz Blinks at a frequency of approx. 0.5 Hz (or irregularly)
LED 2	Power-up: Communication:	Illuminated Flickers during data transmission and receipt

A jumper is included on the PCB (ST8). The display unit can be manually set to the boot mode with this jumper (jumper may not be connected for normal operation).

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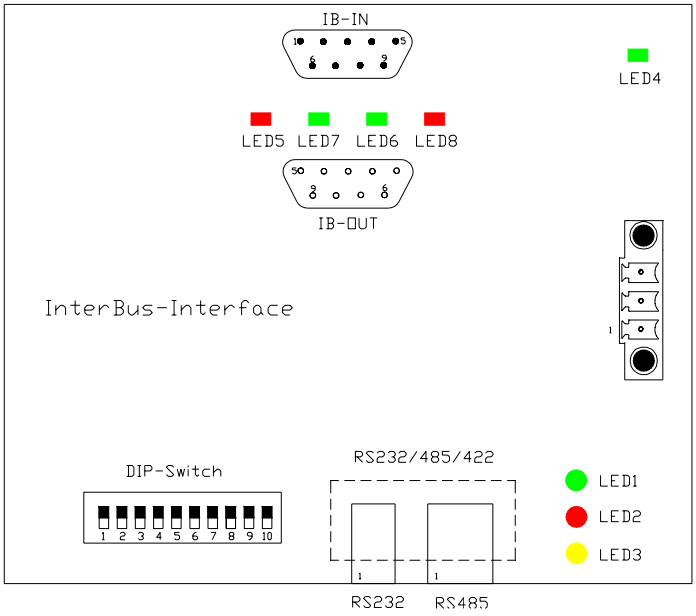
4.3 InterBus-Interface



LED	Description	Status	Meaning
1 (green)	RUN	blinks at approx 2 Hz	CPU-activity
2 (red)	ERROR/UART	blinking On	UART-communication UART-Error
3 (yellow)	BUS	On	cyclic IB-data transmission
4 (green)	SUPI 3-Watchdog	On	normal operation after RESET
5 (red)	ER	On	Error at the IB-module
6 (green)	BA	On Off	bus activity no bus activity since at least 630 ms (Watchdog expired)
7 (green)	CC	On	cable connection of the incoming bus OK and no Interbus-RESET
8 (red)	RD	On	Interbus-RESET or continuing IB-Interface disengaged

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DIP Switch

RS Baud rate / Receiving timeout	DIP 3	DIP 2	DIP 1
1200 Baud / 28 ms	OFF	OFF	OFF
2400 Baud / 14 ms	OFF	OFF	ON
4800 Baud / 7 ms	OFF	ON	OFF
9600 Baud / 4 ms	OFF	ON	ON
19200 Baud / 2 ms (Default RS setting))	ON	OFF	OFF
38400 Baud / 1 ms	ON	OFF	ON
57600 Baud / 1 ms	ON	ON	OFF
115200 Baud / 1 ms	ON	ON	ON

RS Parity / Receiving timeout	DIP 5	DIP 4
no (8N1) / see above	OFF	OFF
even (8E1) / see above (Default RS setting)	OFF	ON
odd (8O1) / see above	ON	OFF
no (8N1) / 30 ms*	ON	ON

*A receiving timeout of 30 ms is used. In operation mode „transmit interface“ the interface works with the setting „7N2“.

Operation mode	DIP 6
Universial interface	ON
Transmit interface (Default RS setting)	OFF

Bus termination	DIP 7	DIP 8	DIP 9	DIP 10
RS 485 set	ON	ON		
RS 485 not set	OFF	OFF		
RS 422 set	ON	ON	ON	ON
RS 422 not set	OFF	OFF	OFF	OFF

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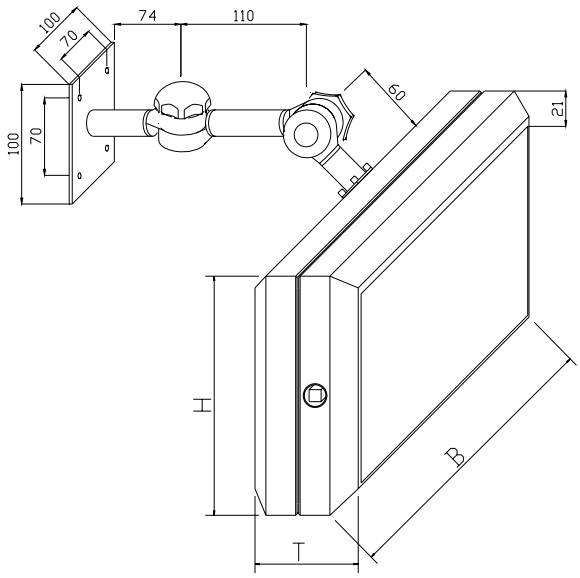
5 Housing Dimensions



migra SC/MC 5 (mm)

	1 Modul			2 Module			3 Module			4 Module		
	B	H	T	B	H	T	B	H	T	B	H	T
1 Modul	620	202	87	1080	202	87	1559	202	87	2047	202	87
2 Module	620	338	87	1080	338	87	1559	338	87	2047	338	87
3 Module	620	448	87	1080	448	87	1559	448	87	2047	448	87
4 Module	620	571	87	1080	571	87	1559	571	87	2047	571	87

migra SC/MC 5 (inches)

	1 Modul			2 Modules			3 Modules			4 Modules		
	B	H	T	B	H	T	B	H	T	B	H	T
1 Module	24,41	7,95	3,43	42,52	7,95	3,43	61,38	7,95	3,43	80,59	7,95	3,43
2 Modules	24,41	13,31	3,43	42,52	13,31	3,43	61,38	13,31	3,43	80,59	13,31	3,43
3 Modules	24,41	17,64	3,43	42,52	17,64	3,43	61,38	17,64	3,43	80,59	17,64	3,43
4 Modules	24,41	22,48	3,43	42,52	22,48	3,43	61,38	22,48	3,43	80,59	22,48	3,43

migra SC/MC 3 (mm)

	1 Modul			2 Module			3 Module			4 Module		
	B	H	T	B	H	T	B	H	T	B	H	T
1 Modul	368	202	87	620	202	87	920	202	87	1180	202	87
2 Module	368	238	87	620	238	87	920	238	87	1180	238	87
3 Module	368	280	87	620	280	87	920	280	87	1180	280	87
4 Module	368	338	87	620	338	87	920	338	87	1180	338	87

migra SC/MC 3 (inches)

	1 Module			2 Modules			3 Modules			4 Modules		
	B	H	T	B	H	T	B	H	T	B	H	T
1 Module	14,49	7,95	3,43	24,41	7,95	3,43	36,22	7,95	3,43	46,46	7,95	3,43
2 Modules	14,49	9,37	3,43	24,41	9,37	3,43	36,22	9,37	3,43	46,46	9,37	3,43
3 Modules	14,49	11,02	3,43	24,41	11,02	3,43	36,22	11,02	3,43	46,46	11,02	3,43
4 Modules	14,49	13,31	3,43	24,41	13,31	3,43	36,22	13,31	3,43	46,46	13,31	3,43

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6 Appendix

6.1 Standard Equipment

- Display unit with current software and hardware versions
- Square socket key
- User's manual
- Socket connector for power supply
- Mating plug for Interface.

6.2 Optional Accessories

- Square socket key
- User's manual.

6.3 Order Numbers

Designation	Order number
Square socket key	G4-041
User's manual (A4 format, German)	X-M31-9AXX7X-003
User's manual (A4 format, English)	X-M32-9AXX7X-003

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6.4 Displayable Characters

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, as well as any user defined character set can be used.

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6.5 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 allow for 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 display 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, including recommended temperature 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 repair the device yourself. The guarantee is rendered null and void if the device is tampered with by unauthorised persons.
- Observe all notes and instructions included in this user’s manual.

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6.6 Declaration of Conformity

microSYST Systemelectronic GmbH, Zur Centralwerkstätte 10,
92637 Weiden, Germany

does hereby declare that the product described in this user's manual,

"migra SC/MC"

to which this declaration makes due reference,
is in compliance with the following standards or normative documents:

Interference emission: generic standard EN 50081 - 2, issued July 1993
Product standard: EN 55011; group 1/2; class A, issued March 1991
Limit values identical to EN 55022

Interference immunity: generic standard EN 50082 - 2, issued March 1995
Basic specification per table

In accordance with regulations specified by guideline 89/336/ EWG (and EMVG).

Weiden, 22 November 1999 microSYST Systemelectronic GmbH

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6.7 Guarantee

The display is guaranteed for the duration of the legally specified period against defects which existed at the time the device was delivered to the buyer.

The device is subject to technical change without notice. Errors and omissions are excepted. No claims can be honoured for the shipment of a new product. The buyer is required to make notification of defects within 2 weeks after identification of such. Non-observance of notification requirements is equated with acceptance of the defect.

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 all required and/or useful information regarding defects at no charge, as well as to the affected devices, 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” regarding manufactured products and services rendered for the electrical industry apply as well.

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6.8 Versions Overview

Ver.	Date	Remark, Description
1.00	5/25/00	
2.00	4/4/01	Bargraph
2.01	6/20/01	
2.10	12/13/01	Kreuzer: Layout
2.20	12/19/01	Kreuzer: New IB-Interface (EBG194)
2.30	12/19/01	Kreuzer: Housing dimensions changed
2.40	2/6/02	Kreuzer: Receiving timeout changed
2.50	5/6/02	Kreuzer: New dummy „*“ added
3.00	11/20/02	Kreuzer: Pin assignment RS232 changed
3.10	12/17/02	Kreuzer: New logo
3.20	5/6/02	Kreuzer: Pin assignment RS485 added
3.30	10/8/03	Kreuzer: New control unit
3.40	3/7/06	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

Certified per **DIN EN ISO 9001:2000**.

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