

Interface description Digital 2-channel indicator MDA2-48



D 91.321.2

8.92/V ~~73900~~

74654

Operating Instructions

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NOTE:

All necessary settings and, where appropriate, alterations by the specialist are described in these Operating Instructions.

If, however, any difficulties should arise during start-up, you are asked not carry out any manipulation on the instrument which is not permitted. - You could endanger your rights under the instrument warranty. Please contact the nearest office or the main factory.

1 INTRODUCTION

The interfaces RS232 (also known as V.24), RS422 and RS485 provide for data communication with computers or host systems. The RS232 (V.24) permits connection of one indicator per computer interface. The interfaces RS422 and RS485 provide for linking up to 31 units per computer interface through a data bus, i.e. connection to one or two common pairs of lines. For identification purposes each indicator is provided with a different device number. Both interfaces are treated identically with regard to software.

2 ELECTRICAL CONNECTION

Wherever possible, screened cable should be used to connect up the interfaces; with RS 422/485 twisted cables are often adequate. The screen must be connected to the housing potential (PE).

The maximum line length depends on the quality of the screening and the strength of any stray electromagnetic fields. It is approx. 30 m in the case of the RS232 and approx. 1200 m with the RS422/485. The handshake line may be omitted when connecting up the RS232 interface; the corresponding connections on the indicator then remain open-circuit.

RS232 interface

Linking an indicator to an IBM XT, AT or PC computer¹⁾.

	Terminal		Pin	
RxD	91		2	RxD
TxD	93		3	TxD
CTS	92		8	CTS
RTS	94		7	RTS
GND	90		5	GND
			1, 4, 6	DCD, DTR, DSR

with handshake

	Terminal		Pin	
RxD	91		2	RxD
TxD	93		3	TxD
CTS	92		8	CTS
RTS	94		7	RTS
GND	90		5	GND
			1, 4, 6	DCD, DTR, DSR

without handshake

RS422 interface

Linking an indicator to an IBM XT, AT or PC computer¹⁾. Pin connections of the 9-pin sub-D connector.

	Terminal		Pin	
IN	(+)	91		4 (+) OUT
	(-)	92		5 (-)
GND		90		3 GND
	(+)	93		8 (+) IN
OUT	(-)	94		9 (-)
				1 (+) RTS, 2 (-), 6 (+) CTS, 7 (-)

It is not essential to connect together the signal ground points (GND). This may however be useful when widely differing potentials are produced in the units due to inadequate isolation

3 INTERFACE PARAMETERS

The interface parameters are determined at the configuration level (see Operating Instructions D 91.321, Section 6.3).

4 TRANSFER PROTOCOL

The protocol is handled exclusively in ASCII code. Additional blank characters are permitted, but the total number of characters per command line is limited to 20. Configuration of the unit through the interface is not possible, but the set configuration can be read out. Programming from the keys on the indicator always has preference.

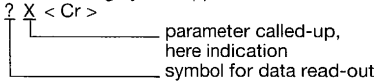
Communication between computer and indicator is possible in any operating mode of the indicator. Inhibiting individual levels inside the indicator has no effect.

¹⁾ Registered trade mark of the Internal Business Machine Corp.

5 INPUT AND OUTPUT SYNTAX

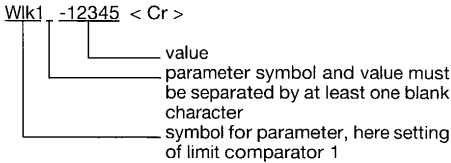
5.1 Indication and data read-out with RS232

The following syntax applies to data read-out:



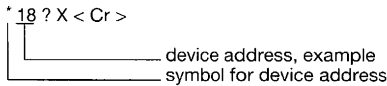
5.2 Parameter programming with RS232

The following syntax applies to programming:

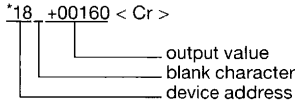


5.3 Syntax with interfaces RS422/485

In the case of the RS422/485 interface the address of the called-up device must precede the command:



In the same way all responses are preceded by the device address:



<Cr> = control character "carriage return"

5.4 General note

The indicator outputs all values as 5 digits with sign, with leading zeroes and without decimal point.

The conversion of the output to the decimal places set on the indicator must therefore be performed by the host computer.

The decimal places in the program can be ascertained by calling up the configuration code C112.

As soon as the input is terminated with "carriage return", it is processed by the indicator and acknowledged with "OK", the called-up value, or an error message.

Other possible responses:

- 19999 overrange
- 19999 underrange
- 19998 terminal temperature compensation faulty
- - - - measured value store faulty

Syntax errors (input of an incorrect command) and logic errors (exceeding range of values, value cannot be programmed etc.) are acknowledged by outputting a question mark followed by the letters ERROR and an error number (see Section 8).

It is useful to check the error status (?ERR <Cr>) before calling up measured values.

The measured values are only valid with error code "00".

Example	Input	Instrument response with	
		correct input	incorrect input
Programming	WLK1 350	OK	? ERROR xx
Read-out	?WLK1	+00350	

5.5 Codes of interface communication

The following table lists the parameters which can be read out or programmed:

Code	Description	Display symbol	r = read-out p = programmable
X	measured value at input 1 or reference value for ratio measurement or difference or humidity value (humidity is always output without decimal places)	InP1 ACt	r r
XC	reference value (input 1) in difference or humidity measurement or ratio value (ratio is always output with 2 decimal places)	InP1 ACt	r r
X2	measured value at input 2	InP2	r
MIN1, MIN2	minimum measured value at input 1 or 2	Lo1, Lo2	r
MAX1, MAX2	maximum measured value at input 1 or 2	Hi1, Hi2	r
HOL1, HOL2	measured value store on input 1 or 2	HoL1, HoL2	r
TAR1, TAR2	tare value with automatic tare	-	r
EXT1, EXT2	software closing or opening of external contact 1 or 2 by the command EXT1(2) ON <Cr> or EXT1(2) OFF <Cr> If the called external contact is opened in hardware, the interface command is carried out. If the contact is closed, the interface command is ignored. The response in both cases is "OK <Cr>" When initiating the function "measured value store" via the interface the stored value does not appear on the normal display. The request ?EXT1(2) <Cr> gives the status of the hardware contact. Any preceding programming via the interface is not recognised.		r/p
WLK1, WLK2 ¹⁾	limit values of the limit comparator	AL1, AL2	r/p
DAC1, DAC2	adjust programmable analogue outputs. An analogue current or voltage output can be adjusted in 1000 steps between 0.0 and 100.0% of the output signal. Example: DAC1 950 <Cr> On request: ?DAC1(2) <Cr> Response: +00950	-	r/p
ERR	error status The response is either "00" if no error is present, or a 2-digit error code. The error codes are described in Section 8.	Er	r

Code	Description	Display symbol	r = read-out p = programmable														
REL	<p>relay status</p> <p>The response is a 3-digit binary number, with the two digits on the right assigned to one relay each.</p> <p>Example of response: 0 0 1 < Cr ></p> <p>no meaning _____ relay 2 on relay 1 off</p>	-	r														
GR1	<p>group read-out of the following measured values or parameters:</p> <table border="1"> <thead> <tr> <th>measured value</th> <th>response position</th> </tr> </thead> <tbody> <tr> <td>measured value X*</td> <td>1 - 11</td> </tr> <tr> <td>measured value of input 2</td> <td>12 - 22</td> </tr> <tr> <td>relay status</td> <td>23 - 26</td> </tr> <tr> <td>error status</td> <td>27 - 29</td> </tr> </tbody> </table> <p>Example: ?GR1 <Cr> Response: +00123 ?ERROR 83 001 00 <Cr></p> <p>*for ratio measurement measured value XC</p>	measured value	response position	measured value X*	1 - 11	measured value of input 2	12 - 22	relay status	23 - 26	error status	27 - 29	-	r				
measured value	response position																
measured value X*	1 - 11																
measured value of input 2	12 - 22																
relay status	23 - 26																
error status	27 - 29																
GR2	<p>group read-out of the following measured values:</p> <table border="1"> <thead> <tr> <th>measured value</th> <th>response position</th> </tr> </thead> <tbody> <tr> <td>minimum value of input 1</td> <td>1 - 11</td> </tr> <tr> <td>minimum value of input 2</td> <td>12 - 22</td> </tr> <tr> <td>maximum value of input 1</td> <td>23 - 33</td> </tr> <tr> <td>maximum value of input 2</td> <td>34 - 44</td> </tr> <tr> <td>measured value store input 1</td> <td>45 - 55</td> </tr> <tr> <td>measured value store input 2</td> <td>56 - 66</td> </tr> </tbody> </table>	measured value	response position	minimum value of input 1	1 - 11	minimum value of input 2	12 - 22	maximum value of input 1	23 - 33	maximum value of input 2	34 - 44	measured value store input 1	45 - 55	measured value store input 2	56 - 66	-	r
measured value	response position																
minimum value of input 1	1 - 11																
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maximum value of input 1	23 - 33																
maximum value of input 2	34 - 44																
measured value store input 1	45 - 55																
measured value store input 2	56 - 66																
Cxxx ¹⁾	<p>configuration data</p> <p>As reponse the indicator sends the current number combination of the configuration code (see Operating Instructions D 91.321, Section 6.)</p> <p>Example: ?C111 < Cr > Response: 00011 < Cr ></p>	Cxxx	r														
VERS	<p>version number</p> <p>Calling up hardware and software version (corresponds to C 800 in Sd08)</p>	C800	r														

¹⁾ The number of writing cycles in programming WLK or of configuration changes is limited (data protection in EEPROM). 10 000 cycles are guaranteed.

5.6 Programming example

In the example below the measured value is read out (line 20) and the limit value is programmed (line 60), in the programming language BASIC, using an RS422 or RS232. The example refers to a computer Type IBM XT/AT¹⁾

10 OPEN	"COM1:9600,N,8,1"AS#1	Opening the interface
20 PRINT	#1,"?X"; CHR\$(13);	Transferring the measured value read-out to the interface, termination with < Cr >
30 INPUT	#1,A\$	Receiving the response
40 PRINT	A\$	Output the measured value
50 INPUT	"limit Wik1 =", B\$	Input of limit value
60 PRINT	#1,"Wik1"; B\$; CHR\$(13)	Transferring the limit programming to the interface
70 INPUT	#1,C\$	Receiving the acknowledgment
80 PRINT	C\$	Output of acknowledgment "OK" or an error message
90 CLOSE	#1	
100 END		

If there is no acknowledgment from the indicator linked to the computer, e.g. due to a faulty interface line, the program does not continue at line 30 or 70 and must be aborted. This can be avoided by checking before the INPUT command whether any characters have arrived at the input buffer (see programming example in the Appendix).

6 TRANSFER PROTOCOL TIMING

RS232 and RS422/485

After the command from the computer has been terminated with < Cr > it is processed by the indicator. The time required for processing the command is shown in the table alongside.

Interface	RS232	RS232, RS422/485
	terminal mode on	terminal mode off
Single command	400 - 800 msec	< 2 - 400 msec
Group command	1600 - 3200 msec	1200 - 2800 msec



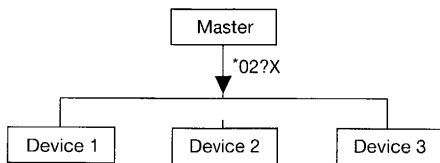
With the RS422 the operating system of the computer generally operates the changeover from "sending" to "receiving" and there is no need to take this into account in programming. In the case of the RS485 this changeover must be taken into account in programming (see Section 7.4).

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7 SPECIAL FEATURES OF THE INTERFACES

7.1 The EOT command

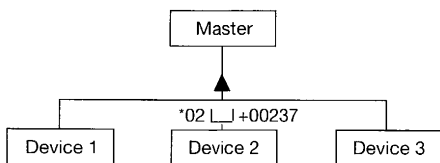
The advantage of this command is a return to a defined status after an incomplete or incorrect transfer, for example. Processing of this sign takes 40 μ sec. With the bi-directional RS422 an EOT interrupts the response of the device connected to it. In the case of the RS485 it is necessary to wait for a possible response before sending the EOT. EOT is sent without device address or Carriage Return.



To send a message to device 2, the master computer sends the message to all devices connected to the bus, preceded by the device address.

7.2 Handshake operation with RS232

During the initialisation phase or the processing of a command the RTS line is set inactive. When the CTS line is blocked at the receiver, the indicator will try for 20 sec to send the command; this will then be erased.



Device 2 responds stating the device address.

7.3 Bus operation with RS422 and RS485

The interfaces RS422 and RS485 provide for linking up to 32 devices (including the host computer) to a "data bus", i.e. one (RS485) or two (RS422) common line pairs.

The indicator operates in the master/slave mode, i.e. it can only transmit after a command from a master computer. For its identification each device connected to the bus is given a number (0 - 31) which on the indicator is laid down under Code C414. A device number must only be allocated once. The master computer precedes the command by the number of the device being addressed; the response from the devices (slaves) is always preceded by their own number.

7.4 RS485 interface

The RS485 interface is permanently switched to "receive" and switches to "send" only when the computer sends a command. This is achieved by re-writing a buffer location in the program. The buffer address is computer-specific and depends also on which of the interfaces available on the computer is being used. With the appropriate circuitry an RS422 interface can also be used as RS485. Here again it is necessary to switch over between "sending" and "receiving" (see programming example in the Appendix).

Device address	Syntax
0	'00
1	'01
2	'02
3	'03
4	'04
5	'05
.	.
.	.
31	'31

8 LIST OF ERROR MESSAGES

The error messages marked with an asterisk (*) in the list below can be called up with the command ?ERR.

Code	Cause	Remedy/Note
ERROR 11	(*) Watchdog error	Switch off indicator, switch on again after a brief interval.
ERROR 20	(*) EEPROM data corrupted	The parameters of the parameter and configuration levels must be loaded from the EPROM with the factory-set parameters (see Operating Instructions D 91.321, Section 8), or input again via the keys.
ERROR 30	(*) Occurs when $X0 = X1$ or $X1 = 0$ has been programmed.	see Section 10.1 in the Operating Instructions D 91.321.
ERROR 40	(*) Display capacity exceeded. This error message is produced in the presence of an indicated value which exceeds the set indication capacity.	Select a smaller number of decimal places or reduce the parameter value.
ERROR 80 ¹⁾	Interface not active. This error message acknowledges any command from the indicator keys, and on input of AI1(2) any programming command.	Send the command again.
ERROR 81 ¹⁾	The parameter entered exceeds the definition range.	Input new value.
ERROR 82 ¹⁾	Parameter cannot be programmed.	Enter different parameter.
ERROR 83 ¹⁾	Parameter not present in the current device configuration or syntax error in input.	Enter different parameter or repeat input correctly.

¹⁾ interface errors

9 APPENDIX

Programming example

The program below provides a quasi-terminal dialogue between a computer (IBM¹⁾ XT/AT) and an indicator MDA2-48 with RS485 interface. The RS422 interface of the computer is used here as an RS485 by the program switching from "send" to "receive" (see connection diagram). The command in line 40 requests before the INPUT # command whether a character has arrived in the buffer.

This ensures that the program continues if there is no message from the indicator; this would not be the case for the INPUT # command by itself.

Using the interface COM1

```
10 DEF SEG = 0
20 CLS:KEY OFF:OPEN"COM1:9600,N,8,1,LF" AS#1
30 OUT &H2FC,INP(&H2FC) AND &HFD
40 WHILE LOC(1) > 0:A$=INPUT$(LOC(1),#1):WEND
50 A$=INKEY$:IF A$=""THEN 90
60 OUT &H2FC,INP(&H2FC) OR 2
70 PRINT #1,A$;:FOR I=1 TO 25:NEXT
80 OUT &H2FC,INP(&H2FC) AND &HFD
90 IF LOC(1) = 0 THEN 50
100 IF LOC(1)>0 THEN A$=INPUT$(LOC(1),#1):PRINT A$;
110 GOTO 90
```

When using the interface COM2 the address &H3FC replaces the address &H2FC.

¹⁾ Registered trade mark of the International Business Machines Corp.