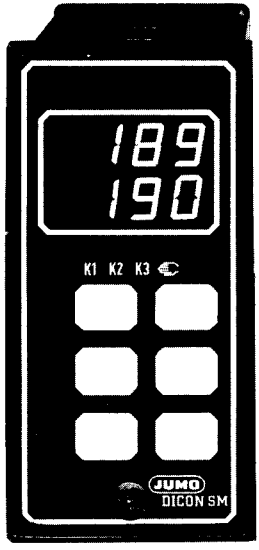
JUMO

MEASUREMENT AND CONTROL

INTERFACE DESCRIPTION of the universal compact controller JUMO DICON SM



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Operating Instructions

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IMPORTANT NOTE:

All necessary settings and, where appropriate, alternations are described in these Operating Instructions. If, however, any difficulties should arise during start-up please do not carry out any manipulations on the instrument which are not permitted. You could endanger your rights under the instrument warranty. Please contact the nearest office or the main factory.

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INTERFACE DESCRIPTION

1 INTRODUCTION

The interfaces RS232 (also known as V.24), RS422 and RS485 provide for data communication with computers or intelligent host systems.

Interface RS232 (V.24) permits the connection of one controller per computer interface. Interfaces RS422 and RS485 provide for linking up to 31 devices to one computer interface through a data bus, i.e. connection to one or two common pairs of lines. For identification purposes each controller is provided with a different device number. Both interfaces are treated identically with regard to software.

2 ELECTRICAL CONNECTION

Wherever possible, screened cables should be used to connect up the interfaces; in the case of the RS422/485 twisted cables are often adequate. The screen must be held at the housing potential (PG).

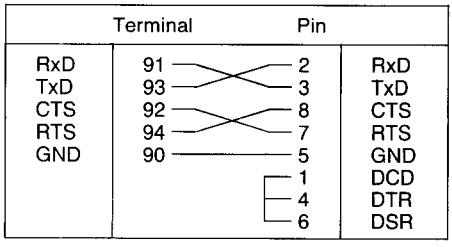
The maximum line length depends on the quality of the screening and the strengths of any stray electro-magnetic fields; it is approx. 30 m in the case of the RS232 and approx. 1200 m with the RS422/485.

The handshake line may be omitted when connecting up the RS232 interface.

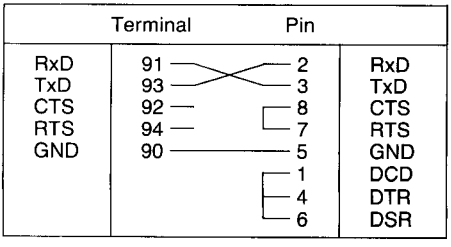
RS232 interface

Linking a DICON SM to an IBM XT, AT or PC[1] computer.

Pin connection of 9-pin sub-D connector



with handshake

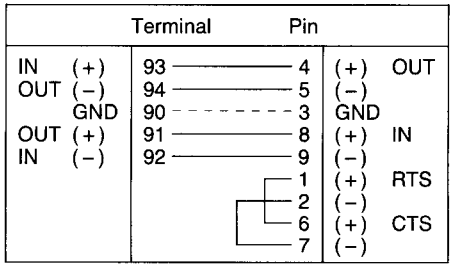


without handshake

RS422 interface

Linking a DICON SM to an IBM XT, AT or PC[1] computer.

Pin connection of 9-pin sub-D connector



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

3 INTERFACE PARAMETERS

The interface parameters are determined at the configuration level (see Operating Instructions D97.560).

4 TRANSFER PROTOCOL

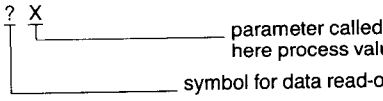
The protocol is handled exclusively in ASCII code strings. Additional blank spaces are permitted, but the total number of characters per command line is limited to 20. Configuration of the unit through the interface is not possible, but the set configuration can be read out.

[1] Trade mark of the International Business Machines Corp.

5 INPUT AND OUTPUT SYNTAX

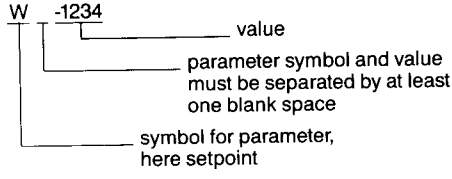
5.1 Process value and data read-out RS232

The following syntax applies to data read-out:



5.2 Read-out and programming of parameters RS232

The following syntax applies to programming:

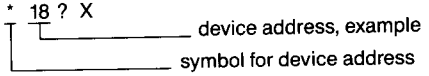


The controller outputs all values as 4-digits groups with sign, leading zeroes and without decimal point. The conversion of the output to the decimal places set on the controller must therefore be performed by the host computer. The decimal places in the program can be ascertained by calling up the configuration code C 112.

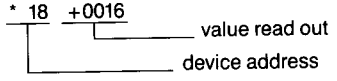
As soon as the input is terminated with "carriage return", it is processed by the controller and acknowledged with "OK", the called-up value, or an error message.

Syntax with interfaces RS422/485

In the case of the RS422/485 interface the address of the device must precede any command.



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



Example:	Input	Controller response	
		correct input	incorrect input
Programming	TV 350	OK	? ERROR xx
Read-out	? TV	+0350	

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

The parameters which can be read out or programmed are listed below.

Parameter	Code	Display/symbol	a = read-out p = read-out/programming
Controller input (process)	X	–	a
Controller output (stroke)	Y	Y	a
2nd process variable	X2	Inp 2	a
Setpoint On programming W the setpoint is stored in the EPROM and cannot be lost	W (The number of writing cycles is limited; 10.000 are guaranteed.)	SP	p
Setpoint On programming WRAM the setpoint is not stored in the EEPROM. After a reset the old setpoint stored in EEPROM is loaded	WRAM	SP	p
Ramp setpoint	WR	–	a
Additional setpoints	W1 W3 W2 W4	SP1 SP2 SP3 SP4	p
Feedback structure	STRU	Stru	p
Proportional band (X_{p1})	XP1	Pb. 1	p
Proportional band (X_{p2})	XP2	Pb. 2	p
Contact spacing	XSH	db.	p
Derivative time	TV	d.t	p
Reset time	TN	r.t	p
Stroke time	TL	t.t.	p
Switching differential (X_{k1})	XD1	Hys. 1	p
Switching differential (X_{k2})	XD2	Hys. 2	p
Cycle time (X_{k1})	CY1	Cy. 1	p
Cycle time (X_{k2})	CY2	Cy. 2	p
Operating point	Y0	y.0	p
Max. stroke	Y1	y.1	p
Max. stroke	Y2	y.2	p
Ramp slope	RAMP	rA.Sd	p
Setpoint lk output 2	WLK2	Al.1	p
Setpoint lk output 3	WLK3	Al.2	p
Controller output in hand mode	YH	YH	p
Hand/auto mode	HAND ON/OFF		p
Self-optimisation	TUNE ON/OFF		p

	Code	a = read-out p = read-out/ programming
Error status The response is a 2-digit number corresponding to the error messages 10 to 40 listed in Section 8. If there is no error message the output is "00".	ERR	a
Relay The response is a 3-digit number consisting of the digits zero and one, each digit corresponding to a relay. "One" represents "relay energised". Example: response "011" means "relay 2 and relay 3 energised"	REL	a
Calling up a group A single command can be used for simultaneous read-out of measured values, relay status, error status and manual mode. The process values are output so that each one starts in the first position and blank spaces are added so that they always have a length of 10 characters. An error message may be output instead of a process value. The parameters are always separated by a blank space. Process 1 Process 2 Stroke Setpoint REL ERR HAND Example: —0123___? ERROR 83___ +0100____ +6780____011_00_OFF 54 characters Process 1 Position 1 – 11 Process 2 Position 12 – 22 Stroke Position 23 – 33 Setpoint Position 34 – 44 Relay Position 45 – 48 Error status Position 49 – 51 Manual mode Position 52 – 54	GR1	a
Configuration data The read-out is obtained by entering the appropriate configuration code (see Operating Instructions D 97.560). The controller responds by outputting the code number which would also be shown on the display. Example: Reading out "Time Out" Input: ? C518	Cxxx	a

5.3 Programming example

In the example below the process is read out (line 20) and the setpoint is programmed (line 60) in the programming language BASIC, using an RS422 or RS232. The example refers to a computer Type IBM XT/AT[1].

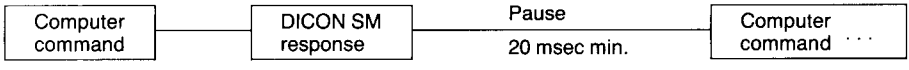
```
 10 OPEN "COM1: 9600,N,8,1" A$#1   Opening the interface
 20 PRINT#1, "? X"; CHR$(13);      Transferring the process read-out to the interface,
                                   terminating with <CR>
 30 INPUT#1, A$                    Receiving the response
 40 PRINT A$                       Output the process value
 50 INPUT "SETPOINT W =", B$       Input of setpoint
 60 PRINT#1, "W"; B$; CHR$(13);    Transferring the setpoint programming to the interface
 70 INPUT#1, C$                    Receiving the acknowledgement
 80 PRINT C$                       Output of acknowledgement "OK" or error message
 90 CLOSE#1
100 END
```

If there is no acknowledgement from the controller 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 in the input buffer (see Programming example in the Appendix).

6 TRANSFER PROTOCOL TIMING RS232 and RS422/485

After the command has been terminated by the computer with <CR> it is processed by the DICON SM. 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	200 – 400 msec	< 2 – 200 msec
Group command	1200 – 1400 msec	1000 – 1200 msec



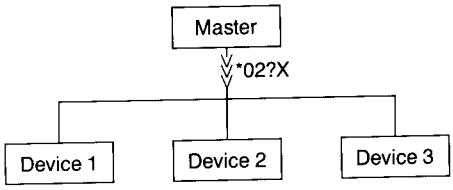
In the case of the RS422 the operating system of the computer generally operates the change-over from "sending" to "receiving" and there is no need to take this into account during programming. In the case of the RS485 this changeover must be taken into account during programming (see Section 7.4).

[1] Trade mark of the International Business Machines Corp.

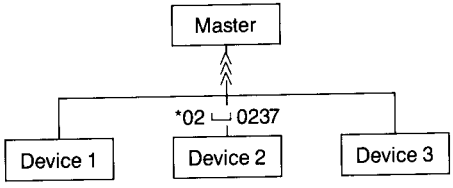
7 SPECIAL FEATURES OF THE INTERFACES

7.1 EOT command

The advantage of this command is a return to a defined start status after an incomplete or incorrect transfer, for example. Processing this character takes 40 μsec.
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 transmitted without device address and carriage return.



The master computer sends a command to device 2 preceded by the device address to all units connected.



Device 2 responds stating the device address.

7.2 Handshake operation of the 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 controller will try for 20 sec to send the command; it will then be erased.

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 DICON SM 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 DICON SM is laid down under Code C 414. A device number may only be allocated once. The master computer precedes the commands by the number of the device to be addressed; the response from the devices (slaves) is always preceded by their own number.

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

7.4 RS485 interface

The RS485 interface is permanently switched to "receive" and only switches to "send" when the computer sends a command. This is achieved through the appropriate memory location in the program being re-written accordingly.
The memory address is computer-specific and depends also on which of the interfaces available at 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 under Programming example in the Appendix).

8 LIST OF ERROR MESSAGES

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

ERROR 11 (*) Watchdog error.
Cancellation by switching off the controller and switching it on again.

ERROR 20 (*) EEPROM data corrupted.
The parameters at the parameter and configuration levels must be loaded at least once with the factory-set parameters from the EPROM.

ERROR 30 (*) Occurs when X0 = X1 has been programmed. See Section "Process correction" in the Operating Instructions D 97.560.

ERROR 40 (*) Display capacity exceeded.
This error message is produced if a process value occurs which exceeds the selected display capacity.
Limit the value.

ERROR 80 Interface not active.
During the initialisation phase or during configuration from the keys, every command to the controller is acknowledged with this error message.

ERROR 81 The parameter entered exceeds the definition range.

ERROR 82 Parameter cannot be programmed.

ERROR 83 Parameter not available in the current instrument configuration (e.g. XP2 on single-setpoint controller).

9 APPENDIX

Programming example

The program below provides a quasi-terminal dialogue between a computer (IBM[1] XT/AT) and a DICON SM with RS485 interface. The RS422 interface of the computer is used here as an RS485 by the program switching over from "sending" to "receiving" (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 DICON SM; this is not 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" A$#1
 30 OUT &H2FC, INP(&H2FC) AND &HFD
 40 WHILE LOC(1) >0:A$=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 address &H2FC.

[1] Trade mark of the International Business Machines Corp.