

**INTERFACE DESCRIPTION**  
**of the universal compact controller**  
**JUMO DICON S and JUMO DICON SC**



**D 97.550.2/540.2**

5.92 74181

**Operating Instructions**

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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 units 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 unit number. Both interfaces are treated identically with regard to software.

## 2 ELECTRICAL CONNECTION

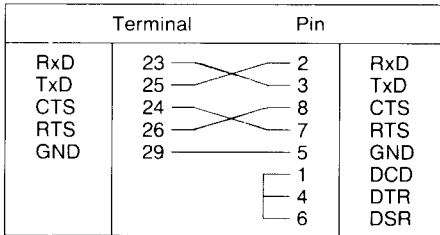
Wherever possible, screened cables should be used to connect up the interfaces; with the RS422/485 twisted cables may be adequate in some cases. The screen must be held at the housing potential (PG). The maximum line length depends on the quality of the screen and the strength of any stray electro-magnetic 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.

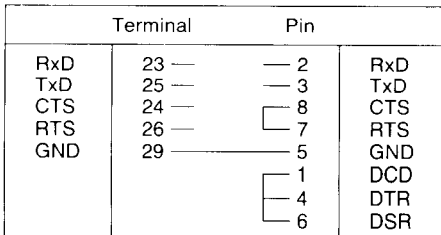
### RS232 interface

Linking a DICON S (SC) to an IBM XT, AT or PC<sup>1)</sup> computer.

Pin connection 9-pin sub-D connector



with handshake

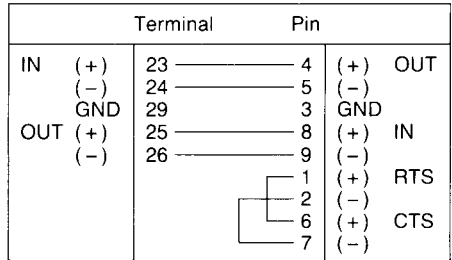


without handshake

### RS422 interface

Linking a DICON S (SC) to an IBM XT, AT or PC<sup>1)</sup> computer.

Pin connection 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 in the configuration plane (see Operating Instructions D97.550).

## 4 TRANSFER PROTOCOL

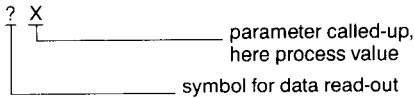
The protocol is handled exclusively in ASCII code strings. Additional blank spaces are permitted, but the total number of characters per command line is limited to 15. Configuration of the unit through the interface is not possible, but the selected configuration can be read out.

<sup>1)</sup> Trade mark of the International Business Machines Corp.

## 5 INPUT AND OUTPUT SYNTAX

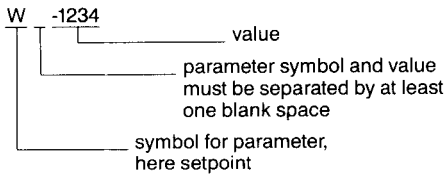
### 5.1 Process value and data read-out RS232

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 with sign, with leading zeroes and without decimal point. The conversion of the output to the decimal places set on the controller must be performed by the host computer. The decimal places in the program can be ascertained by calling up the configuration code C 115.

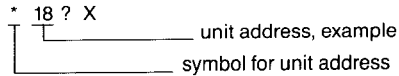
As soon as the input is terminated with "carriage return", it is processed by the controller and acknowledged with "OK", the called-up value, or an error message.

Example:	Input	Controller acknowledgement	
		correct input	incorrect input
Programming	TV 350	OK	} SN
Read-out	? TV	+0350	}> ? ERROR xx

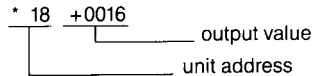
Syntax errors (input of an incorrect command) are acknowledged with "SN" for syntax error. Logical errors (exceeding the value range, value cannot be programmed etc.) are acknowledged with a question mark followed by the letters ERROR and an error number (see Section 8).

### Syntax with interfaces RS422/485

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



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



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

Parameter	Symbol	a = read-out p = read-out/programming
Controller input (process)	X	a
2nd process variable		
return flow temperature	RT	a
reference temperature	BT	a
heater current	HI	a
terminal temperature	KL	a
Setpoint	W	p
Ramp setpoint	WR	a
Additional setpoints	W1 W3 W2 W4	p
Proportional band ( $X_{p1}$ )	XP1	p
Proportional band ( $X_{p2}$ )	XP2	p
Contact spacing	XSH	p
Derivative time	TV	p
Reset time	TN	p
Switching differential ( $X_{d1}$ )	XD1	p
Switching differential ( $X_{d2}$ )	XD2	p
Cycle time ( $X_{k1}$ )	CY1	p
Cycle time ( $X_{k2}$ )	CY2	p
Max. valve stroke	Y1	p
Max. valve stroke (or operating point)	Y2	p
Ramp slope	RAMP	p
Hand/auto mode	HAND ON/OFF	p
Self-optimisation	TUNE ON/OFF	p
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

	Symbol	a = read-out p = read-out/ programming														
<p>Relay</p> <p>The response is a 3-digit number consisting of the digits zero and one, each digit corresponding to a relay. "One" represents "relay energised".</p> <p>Example: response "011" means "relay 2 and relay 3 energised"</p>	REL	a														
<p>Calling up a group</p> <p>It is possible to use a single command for reading out measured values, relay positions, 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.</p> <p>Process 1 Process 2 Process 3 Process 4 REL ERR HAND</p> <p>Example: —0123___ +4567___ ? ERROR 83_ +6780_____ 011_00_OFF</p> <p style="text-align: center;">←————— 54 characters —————→</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Process 1</td> <td style="width: 50%;">Position 1 – 11</td> </tr> <tr> <td>Process 2</td> <td>Position 12 – 22</td> </tr> <tr> <td>Process 3</td> <td>Position 23 – 33</td> </tr> <tr> <td>Process 4</td> <td>Position 34 – 44</td> </tr> <tr> <td>Relay</td> <td>Position 45 – 48</td> </tr> <tr> <td>Error status</td> <td>Position 49 – 51</td> </tr> <tr> <td>Hand mode</td> <td>Position 52 – 54</td> </tr> </table>	Process 1	Position 1 – 11	Process 2	Position 12 – 22	Process 3	Position 23 – 33	Process 4	Position 34 – 44	Relay	Position 45 – 48	Error status	Position 49 – 51	Hand mode	Position 52 – 54	GR1	a
Process 1	Position 1 – 11															
Process 2	Position 12 – 22															
Process 3	Position 23 – 33															
Process 4	Position 34 – 44															
Relay	Position 45 – 48															
Error status	Position 49 – 51															
Hand mode	Position 52 – 54															
<p>Configuration data</p> <p>The read-out is obtained by entering the appropriate configuration code (see Operating Instructions D 97.550 or D 97.540). The controller responds by outputting the code number which would also be shown on the display.</p> <p>Example: Reading out "Time Out" Input: ? C183</p>	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<sup>1)</sup>.

```

10 OPEN "COM1: 9600,N,8,1" A$ #1      Opening the interface
20 PRINT #1, "? X1"; 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

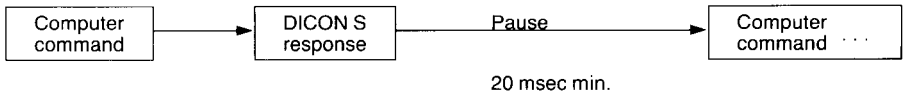
```

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 an RS422/485

After the command has been terminated by the computer with <CR> it is processed by the DICON S. 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	160 – 320 msec	< 2 – 160 msec max.
Group command	960 – 1120 msec	800 – 960 msec



With 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).

<sup>1)</sup> 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 sign takes 40  $\mu$ sec.

With the bi-directional RS422 an EOT interrupts the response of the unit connected to it. In the case of the RS485 it is necessary to wait for a possible response before sending the EOT.

### 7.2 Handshake operation of the RS232

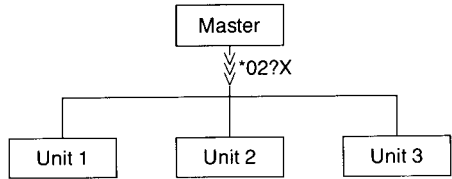
During the initialisation phase or the processing of a command the RTS line is set inactive. When the CTS line is blocked at the receiver, the controller will try for 12 sec to send the command; it will then be erased.

### 7.3 Bus operation with RS422 and RS485

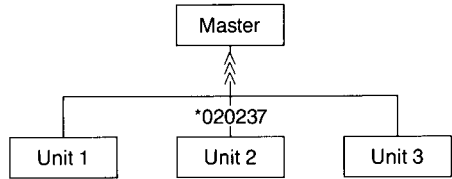
The interfaces RS422 and RS485 provide for linking up to 32 instruments (including the host computer) to a "data bus", i.e. one (RS485) or two (RS422) common line pairs.

The DICON S operates in the master/slave mode, i.e. it can only transmit after a command from a master computer. For its identification each unit connected to the bus is given a number (0–31) which on the DICON S is laid down under Code C 171. A unit number may only be allocated once. The master computer precedes the commands by the number of the unit to be addressed; the response from the units (slaves) is always preceded by their own number.

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



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



Unit 2 responds stating the unit address.

### 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).

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## 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 10 (\*) The voltage of the built-in lithium battery for data back-up has fallen so far that the battery should be replaced.

Call-up through the interface by ?ERR

The error message is cancelled by pressing any key on the membrane keyboard.

ERROR 11 (\*) Watchdog error.

Every request to the computer is acknowledged with this error message.

Cancellation by switching off the controller and switching it on again.

ERROR 20 (\*) RAM data destroyed.

Every request to the computer is acknowledged with this error message.

The parameters of the parameter and configuration plane must be loaded at least once from the EPROM with the factory-set parameters.

ERROR 30 (\*) Occurs when X0 = X1 has been programmed. See Section "Process correction" in the Operating Instructions D 97.550 or D 97.540.

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 keyboard, any 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).

ERROR 84 Hand mode blocked.

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## 9 APPENDIX

### Programming example

The programs below provide a quasi-terminal dialogue between a computer (IBM<sup>1)</sup> XT/AT) and a DICON S with RS485 interface. The RS422 interface of the computer is used here as an RS485 by the program switching over 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 DICON S; 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$#1
30 OUT &H2FC; INP(&H3FC) AND &HFD
40 WHILE LOC(1) > 0:A$=INPUT$(LOC(1), #1):WEND
50 A$=INKEY$:IF A$=""THEN 90
60 OUT &H2FC,INP(&H2FC) OR 2
70 PRINT #1,A$;:FOR I=1 TO25:NEXT
80 OUT &H2FC,INP(&H2FC) AND &HFD
90 IF LOC(1)=0 THEN 50
100 IF LOC(1) > 0 THEN A$=INPUT$(LOC(1), #1):PRINT A$;
110 GOTO 90
```

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

<sup>1)</sup> Trade mark of the International Business Machines Corp.