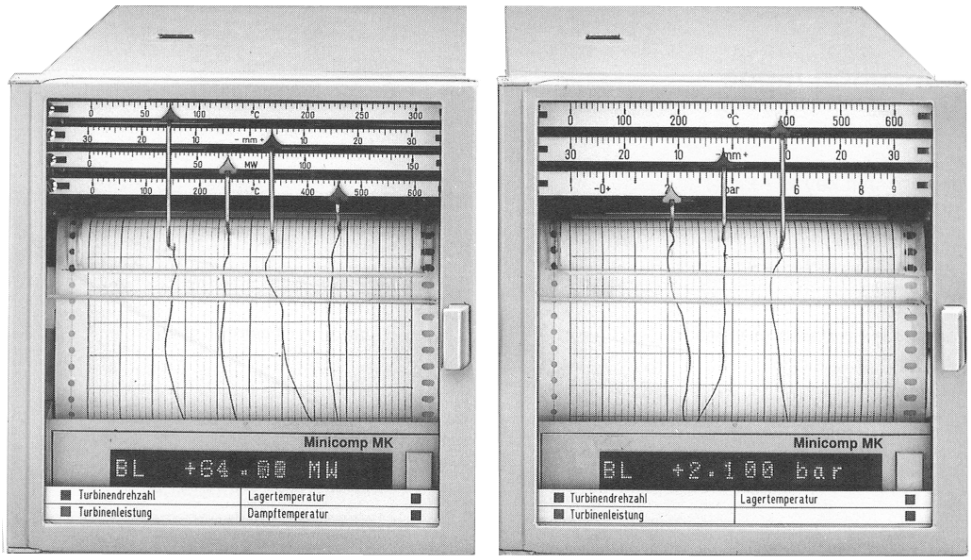

Minicomp MK
BL +64.00 MW
Turbinendrehzahl
Turbinenleistung
Lagertemperatur
Dampftemperatur
Minicomp MK
BL +2.100 bar
Turbinendrehzahl
Turbinenleistung
Lagertemperatur

Table of Contents

Important Instructions for Your Safety. Please read and observe.

Correct and safe operation of the continuous-line recorder Minicomp MK calls for appropriate transportation and storage, expert installation and commissioning as well as correct operation and meticulous maintenance.

Only those persons conversant with the operation and maintenance of similar apparatuses and who possess the necessary qualifications are allowed to work on the apparatus.

Please take note of the contents of this Operating Manual and the safety regulations affixed to the apparatus.

The directives, norms and guidelines mentioned in this Operating Manual are applicable in the Federal Republic of Germany. When using the apparatus in other countries, please observe the national regulations prevailing in the respective country.

The Minicomp MK has been designed and tested in accordance with DIN VDE 0411 Part 1, "Safety Requirements for Electronic Measuring Apparatuses", and has been supplied in a safe condition. In order to maintain this condition, and to ensure safe operation, the safety instructions in this Operating Manual bearing the headline "Caution" must be observed. Otherwise, persons can be endangered and the apparatus itself as well as other equipment and facilities can be damaged.

If the information in this Operating Manual should prove to be insufficient in any point, the Hartmann & Braun Service Department will be delighted to give you more information.

Subject to technical changes.

1 Description

The interfaces RS 232C and RS 485 are available for parameter definition of the continuous-line recorder Minicomp MK. Interface RS 232C is preset. Two slide switches must be changed over on the option card in order to change the interface to RS 485 (see Fig. 1-2).

Parameter definition of the recorder can be effected on the operator panel of the Minicomp MK or, using a PC and the parameter definition programme PARALINE, via the interface. Interface RS 232C is used primarily for parameter definition of the recorder.

A standardized adapter cable (length = 2.5 m; Catalogue No. 43404-0-0319228) is available for using the RS 232C interface. A standardized adapter cable can be used for the RS 485 interface (length = 0.2 m; Catalogue No. 43404-4-0319226).

The serial communication of the continuous-line recorder Minicomp MK according to interface norm RS 485 is based on DIN 19 245 Part 1. Only a subset of the stipulations have been taken into consideration. Inter alia, stipulations regarding multimaster operation (token-passing procedures) have not been taken into account since the continuous-line recorder is always a passive subscriber.

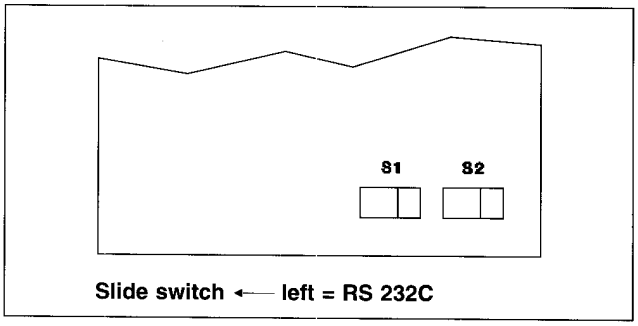


Fig. 1-1 Switch setting on option card for RS 232C

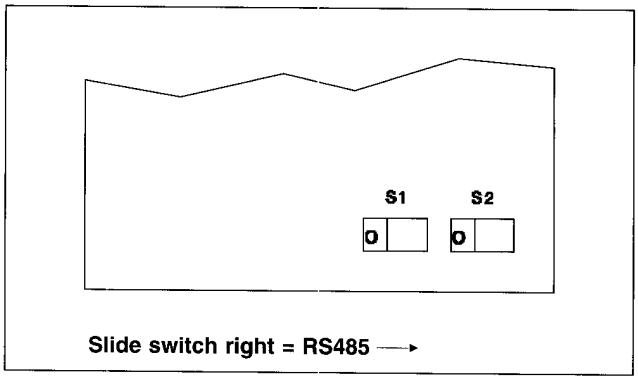


Fig. 1-2 Switch setting on option card for RS 485

2 Technical data

2.1 Point-to-point connection RS 232C

Medium
Shielded 3-wire cable, cross-section min. 0.22 mm².

Cable length
Max. 15 m

Number of subscribers
1 transmitter, 1 receiver

Transmission rate
300, 600, 1,200, 2,400, 4,800, 9,600 and 19,200 bauds

Transmission type
Asymmetrical

Driver output
No-load operation ±15 V, with load ±5 V
Load resistance 3...7 kΩ

Receiver
Sensitivity ±3 V
Input resistance 3...7 kΩ
1 character < −3 V
Blank > +3 V

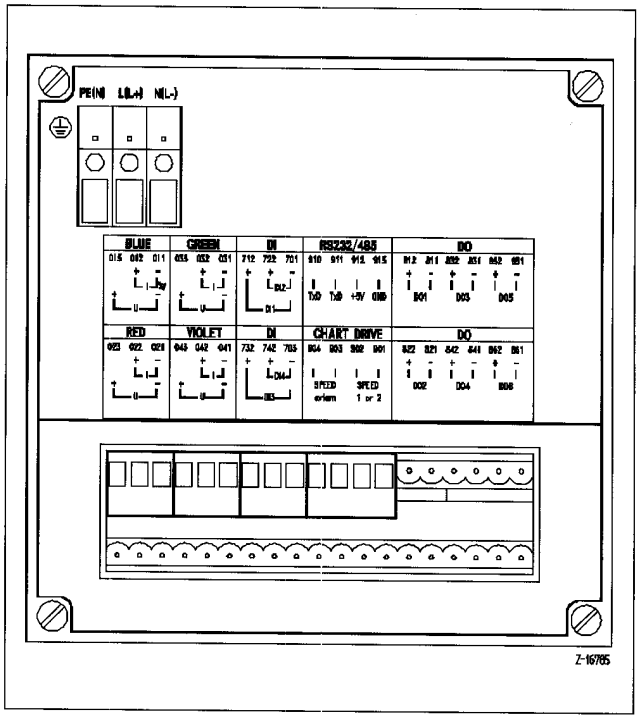


Fig. 1-3 Rear panel of Minicomp MK
Terminal 910 = TXD
Terminal 911 = RXD
Terminal 912 = +5 V (not for RS 232C)
Terminal 913 = GND
(The shield is fitted to a blade-type terminal on the recorder case).

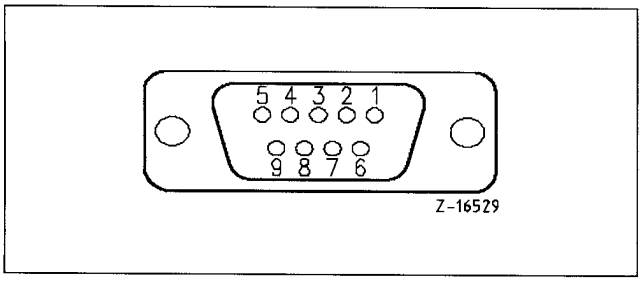


Fig. 2-1-1 Terminal assignment of the RS 232C interface
(9-pin socket SUB-D)
2 = RXD
3 = TXD
5 = GND

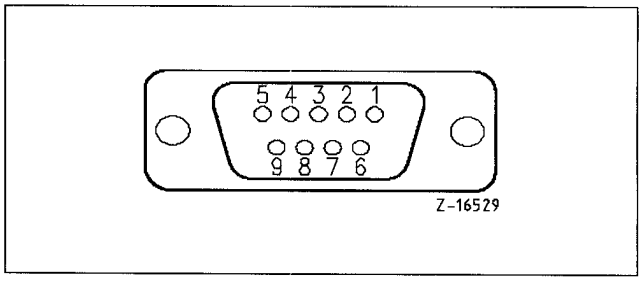


Fig. 2-2-1 Terminal assignment of the RS 485 interface
(9-pin socket SUB-D)
Pin 1: Shield
Pin 3: RXD (+)
Pin 5: GND (ground potential)
Pin 6: +5 V
Pin 8: RXD (–)

Earthing
Earth the shield at both ends to divert high-frequency interferences. Interconnect the ground terminals of both subscribers.

Electrical isolation
None

2.2 Bus connection RS 485

Bus structure
Line, no branches,
Stub line to the subscriber < 0.3 m.

Medium
Shielded, twisted 2-wire leads,
Characteristic impedance 100...130 Ω, at f > 100 kHz
Cable capacitance < 60 pF/m
Cross-section min. 0.22 mm².

Cable length
Max. 1200 m

Number of bus subscribers
32 (active and passive)

Transmission rate
300, 600, 1,200, 2,400, 4,800, 9,600 and 19,200 bauds

Type of transmission
Symmetrical

Driver output
No-load operation ±5 V, with load ≥ ±1.5 V
Load resistance ≥ 60 Ω

Receiver
Sensitivity 200 mV
Input resistance 12 kΩ

Earthing
Earth the shield at both ends to divert high-frequency interference.

Potential equalization
The difference in potential between the Data ground potentials (GND) of all bus subscribers may not exceed ±7 V.

The +5 V voltage at pin 6 is only needed if the Minicomp MK is being operated as a bus terminal unit.
The bus quiescent potential is determined with resistors R_u, R_t and R_d.

R_u = 390 Ω
R_t = 150 Ω
R_d = 390 Ω

Wire according to Fig. 2-2-2.

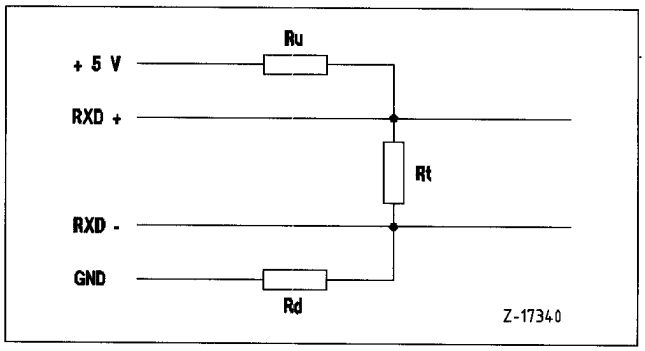


Fig. 2-2-2 Bus terminal wiring

Fit resistors R_u, R_t and R_d in the 9-pin bus connector such that the recorder can be separated from the bus, with the bus, however, remaining properly terminated.

3 Data formats

The data to be transferred are formatted according to 4 different types.
1st type Byte Value range 0...255
2nd type Char Value range −128...+127
3rd type Word Value range 0...65535
4th type Float Value range ±1.175494E-38...±3.402823E+38

Byte type

The Byte-type format is used to select the parameters from the tables (see Section 5.3).

Char type

The Char-type format is used to transmit ASCII characters. The character set accepted by the recorder is listed in Table 8.3.10. The Hex codes must be used.

Word type

The Word-type format consists of 2 bytes and is used to transmit integers without signs. The numerical range accepted by the recorder is between 0...1000. The High byte is transmitted before the Low byte.

Example: The value 820 is to be transmitted
820 dec = 03 34H

Float type

The Float-type format consists of 4 bytes and is used to transmit floating point numbers. The numerical range accepted by the recorder is between −1000 ... +9999 (IEEE-754 format).

Example:
The value −12.5 is to be transmitted.
−12.5 dec. = C1 48 00 00H

Calculation of the Hex number
The general form of the floating point number is:

(Sign) * $2^{EXP-127}$ * (Remainder)

The binary representation of the number −12.5

11000001 01001000 00000000 00000000

EXP (8 bit) Remainder (23 bit)
Negative sign

1. Calculate sign. The bit is set for a negative sign.
2. Calculate exponent. The highest exponent is calculated
   EXP= INT [l_g | $Number_{dec}$ | / l_g 2] + 127
   In the example:
   INT [l_g 12.5 / l_g 2] +127 = 130_{dec} = 82Hex = 10000010 Binary
3. Calculate remainder. Remainder = | $Number_{dec}$ | / 2^{EXP}
   In the example: 12.5 / 2^3 = 1.562

   Conversion to binary code:
   Rank $2^0+2^{-1}+2^{-2}+2^{-3}+2^{-4}+...2^{-23}$
   In the example: 1 1 0 0 1
The value of 2^0 is always 1 and is therefore not transmitted.

4 Data transmission

4.1 General information

A combination of telegram characters is used for the data transmission. The telegrams use the "Handshake function", i.e. each telegram from the computer to the recorder must first be acknowledged before the next telegram can be sent.

Note
Before data transmission, parameters must be set for interface (RS 232C or RS 485), address, parity and baud rate.

4.2 Telegram characters

(UART character or frame)

Each frame (character) has 11 bits:
– one start bit (ST) with logic "0" signal
– 8 information bits with logic "0" or "1" signal
– one parity bit (P) (as option) with logic "0" or "1" signal and
– one stop bit (SP) with logic "1" signal.

0	b1	b2	b3	b4	b5	b6	b7	b8	(P)	1
ST	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	(P)	SP

Fig. 4-2-1 Bits of a frame

4.3 Permissible addresses

With the RS 485 interface set on the Minicomp MK, it only answers queries, which use as destination address the address set in the device. Values between 0...126 (= 7EH) are allowed, with values being specified arbitrarily. However, no address may be specified twice. With RS 232 C all messages are processed, independently of the bus address set. Minicomp MK sends no answer to incorrect messages (checksum, wrong address, any other type of reception errors). Neither are incorrect messages acknowledged. Some data areas are marked as Read Only areas. Attempts to write data to these data fields are ignored by the recorder.

4.3.1 Broadcast address (global address)

Messages to the broadcast address (131 dec.) are always processed. However, no answer is sent for a broadcast message.

4.4 Telegram formats, General specifications

The Minicomp MK accepts the following telegram types:

4.4.1 SD1 telegrams

Telegram with fixed information field length without data field:

SD1/DA/SA/FC/FCS/ED
I<---- L---->I

This is used for sending a query to the recorder and for acknowledgement on the part of the recorder.
The following applies:

SD1 = 10H	Start byte (Start Delimiter), code: 10H
DA	Destination address
SA	Source address
FC	Function code (Frame Control)
FCS	Check byte (Frame Check Sequence) Sum of the Hex values of the "L" frames without carry for FFH
ED	End byte (End Delimiter), code: 16H
L	Number of bytes in FCS = 3

If a query with FC = 01H (ident query) is sent, the response from the recorder will also be sent in the SD1 format. If no self-test error has occurred in the device, FC = 10H is contained in the answer. Otherwise FC = 11H.

The recorder ident code is implemented with the function code 4EH.

The recorder responds **to a query with FC = 4EH** with a message of the SD2 type.

The data field of the identification message is assigned as follows:

VN	= H&B"	Manufacturer's code
CT	= 1. "43412"	Prod. Root No.
	2. "Minicomp MK"	Device designation
HR	= "CPU:A"	Index of the recorder CPU card
SR	= "01.04"	Example of software release

4.4.2 SD2 telegrams

Telegram with variable information field length:
SD2/LE/LEr/SD2/DA/SA/FC/aa/oo/oo/cc/Data field/FCS/ED
I<----------L---------->I

This is used for sending data to the recorder and for data answers from the recorder.

The following applies:

SD2 = 68H	Start byte
LE	Number of data bytes + 7
LEr	Repeat of LE
SD2 = 68H	Repeat of start byte
DA	Destination address (subscriber address)
SA	Source address
FC	Function code (16H = Read; 15H = Write)
aa	Basic address of the parameter field
oo oo	2-byte parameter address (=Offset)
cc	Number of data bytes
Data field	Data to be sent
FCS	Checksum (Sum of the Hex values of "L" frames without carry for FFH)
ED = 16H	End code
L	Number of bytes in FCS

On receiving data message of the SD2 type, the recorder responds with a message in the SD1 format. FC = 10H if all data have been taken over by the recorder, otherwise FC = 11H.

1 minute after reception of the last data message from the recorder, the modified data are copied automatically into the non-volatile memory.

Function code 16H is used when transmitting data to the recorder.

The recorder uses function code 15H for its answer telegrams in the SD2 format.

4.4.3 SD3 telegrams

Telegram with fixed information field length:

SD3/DA/SA/FC/aa/oo/oo/xx/xx/xx/xx/FCS/ED
I<----------L---------->I

Is used to send a query to the recorder.
The following applies:

SD3 = A2H,	Start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 15H	Function code
aa	Basic address of the parameter field
oo oo	2-byte parameter address (Offset)
cc	Number of data bytes
xx xx xx xx	4 arbitrary bytes
FCS	Checksum (Sum of the Hex values of the "L" frames)
ED = 16H	End code
L	Number of bytes in FCS

4.5 Transmission rules

The resting state of the line corresponds to the logic "1" signal. Before commencing data transmission from the computer, a minimum time of 33 bits (syn. time) is needed as a resting state for the synchronization.

Breaks of the length ≥ 3 frames are interpreted as telegram end.

The Minicomp MK takes a break of ≤ 300 ms for the interval between reception of the last stop bit and transmission of the first start bit.

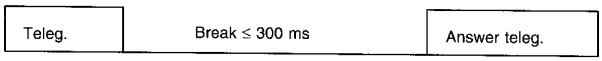


Fig. 4-5-1 Break between two telegrams

The break between individual frames is max. 0.05 ms.

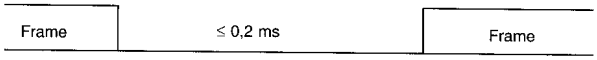


Fig. 4-5-2 Break between two frames

The recipient checks:
– per frame Start, stop and parity bit
– per telegram Start, DA, SA, - , FCS and end byte
If the check returns a negative result, the entire telegram must be rejected as false.

In the answer, the Minicomp MK uses the source address of the transmitted telegram as the destination address and enters its own address as source address.

5 Parameters

5.1 Addressable parameters

The following parameters can be read or modified with the telegrams according to the procedures in Sections 4.4.2 and 4.4.3. To this end, a parameter field address, a parameter address (offset) as well as the coding of the parameter value must be specified.

Please consult Section 5.2 for the parameter field addresses.
Please consult Section 5.3 for the parameter addresses.

The following specifications are therefore needed for the first chart speed:

Parameter field address:	10H
Parameter address (offset):	0002H
Coding of the chart speed 20 mm/h:	0EH

5.2 Assignment of device function group to the parameter field addresses

Device function group	Parameter field address
System parameter definition	10H
Channel parameter definition BL	11H
Channel parameter definition RT	12H
Channel parameter definition GN	13H
Channel parameter definition VI	14H
Text lines	17H
Print intervals	18H
Print synchronization times	19H
Communication parameters	1AH
DI Assignment	1BH
Date & time	1CH
Calibration data	1DH
Measured values and status	1EH
Transmit print line	F1H

During communication, the above addresses are entered into the corresponding fields of a message. From the address, the recorder calculates the data area to be transmitted. Data are transmitted with messages of the SD2 and SD3 types. FC 15H must always be used to read a data field. Data are written into a data field with FC 16H. If invalid parameter values have arrived while writing data into a message, the negative acknowledgement (SD1, FC = 11H) is sent by the recorder as an answer.

The 8-bit data items are always transmitted with a stop bit.
The parity and baud rate must be set according to the values selected in the recorder.

5.3 Parameter addresses

5.3.1 System parameters 10H

Para-meter address (Offset)	Data type	Function and coding
0000H	Word	Password 0000....270EH
0002H	Byte	Chart speed 1 00H = Off 01H = 2.5 mm/h 02H = 5 mm/h 03H = 10 mm/h 04H = 20 mm/h 05H = 30 mm/h 06H = 60 mm/h 07H = 120 mm/h 08H = 240 mm/h 09H = 300 mm/h 0AH = 600 mm/h 0BH = 1200 mm/h 0CH = 1800 mm/h 0DH = 3600 mm/h 0EH = 7200 mm/h
0003H	Byte	Chart speed 2 As speed 1
0004H	Byte	Chart pulse 00H = Off 01H = 0.025 mm/pulse 02H = 0.05 mm/pulse 03H = 0.1 mm/pulse 04H = 0.2 mm/pulse
0005H	Byte	Cycle display 00H = Off 01H...0AH = 1..10 s
0006H	Byte	Date/time format 00H = European 01H = American
0007H	Byte	Alarm acknowledgement 00H = No display 01H = Manual ackt. 02H = Auto ackt.
0008H	Byte	Language 00H = German 01H = English 02H = French
0009H	Byte	Simulation type 00H = Off 01H = Ramp 02H = Sinus 03H = Level (10 %)
000AH	Word	Simulation period 0014..07D0H
000CH	Word	Software revision code
000EH	Byte	Stop key 00H = Off 01H = On
000f	Byte	Collective alarm 00H = Off 01H = DO1 02H = DO2 03H = DO3 04H = DO4 05H = DO5 06H = DO6

5.3.2 Channel parameters 11H...14H

Para-meter address (Offset)	Data type	Function and coding
0000H	Byte	Input type 00H = Off 01H = 4...20 mA 02H = 0...20 mA 03H = 0...10 V 04H = ±5 mA 05H = ±20 mA 06H = ±25 mV 07H = ±100 mV 08H = 0...2.5 V 09H = ±2.5 V 0AH = ±10 V 0BH = Pt 100 (–50...+150) 0CH = Pt 100 (–200...+850) 0DH = TC B 0EH = TC E 0FH = TC J 10H = TC K 11H = TC L 12H = TC R 13H = TC S 14H = TC T
0001H	Byte	Physical unit 00H = mA 01H = A 02H = mV 03H = V 04H = bar 05H = mbar 06H = psi 07H = Pa 08H = kPa 09H = °C 0AH = °F 0BH = K 0CH = m^3/h 0DH = l/s 0EH = % 0FH = ‰ 10H = MW 11H = 1/min 12H = -TEXT- (free unit)
0002H	Float	Measuring range start
0006H	Float	Measuring range end
000AH	Float	Display range start
000EH	Float	Display range end
0012H	Byte	Filter time 0...60 s (00..3CH)
0013H	Byte	Direction 00H = 0->100 01H = 100<-0
0014H	Byte	Root extraction 00H = off 01H = on
0016H	Byte	Reference junction TC 00H = 0 °C 01H = 20 °C 02H = 50 °C 03H = 60 °C 04H = Internal
0017H	Float	Alarm value
001BH	Float	Alarm value

Continuation channel parameters 11H...14H

Parameter address (offset)	Data type	Function and coding
001FH	Byte	Hysteresis for alarm value 5...99 ‰ = 05...63H
0020H	Byte	Time basis dyn. alarm value 3 % / 3..30 s = 03...1EH
0021H	Byte	Alarm value 1 text 00...08H
0022H	Byte	Alarm value 2 text 00...08H
0023H	Byte	Dyn. alarm value text 00...08H
0024H	Byte	Alarm value 1 function 00H = min 01H = max
0025H	Byte	Alarm value 2 function 00H = min 01H = max
0026H	CHAR[ ]	Free phys. unit 00H = 1 character
002C	Byte	Sel. linearization 00H = Off 01H = On
002DH	Word	Tiepoint 1 x_1 = 0...1000 ‰ = 00 00...03 E8H
002FH	Word	Tiepoint 1 y_1 = 0...1000 ‰
0031H	Word	Tiepoint 2 x_2 = 0...1000 ‰
0033H	Word	Tiepoint 2 y_2 = 0...1000 ‰
0035H	Word	Tiepoint 3 x_3 = 0...1000 ‰
0037H	Word	Tiepoint 3 y_3 = 0...1000 ‰
0039H	Word	Tiepoint 4 x_4 = 0...1000 ‰
003BH	Word	Tiepoint 4 y_4 = 0...1000 ‰
003DH	Word	Tiepoint 5 x_5 = 0...1000 ‰
003FH	Word	Tiepoint 5 y_5 = 0...1000 ‰
0041H	Word	Tiepoint 6 x_6 = 0...1000 ‰
0043H	Word	Tiepoint 6 y_6 = 0...1000 ‰
0045H	Word	Tiepoint 7 x_7 = 0...1000 ‰
0047H	Word	Tiepoint 7 y_7 = 0...1000 ‰
0049H	Word	Tiepoint 8 x_8 = 0...1000 ‰
004BH	Word	Tiepoint 8 y_8 = 0...1000 ‰
004DH	Byte	Pt 100 00H = 2-wire circuit 01H = 3-wire circuit
004EH	Byte	Relay contact alarm value 1 00H = Off 01H = DO1 02H = DO2 03H = DO3 04H = DO4 05H = DO5 06H = DO6
004FH	Byte	Relay contact alarm value 2 (as GW 1)
0050H	Byte	Relay contact gradient (as GW 1)
51	Byte	Behaviour in the case of detector rupture 00H = ← 0 01H = 100 →
52	Byte	Line resistance Pt 100, 2-wire circuit 0 = 10 Ω; 1 = 20 Ω; 2 = 30 Ω; 3 = R_L (is measured by the recorder)

5.3.3 Text lines 17H

Para-meter address (offset)	Data type	Function and coding
00..0F	CHAR [ ]	Text line #1 (1st character for offset 00)
10..1F	CHAR [ ]	Text line #2
20..2F	CHAR [ ]	Text line #3
30..3F	CHAR [ ]	Text line #4
40..4F	CHAR [ ]	Text line #5
50..5F	CHAR [ ]	Text line #6
60..6F	CHAR [ ]	Text line #7
70..7F	CHAR [ ]	Text line #8

Unoccupied character positions must be occupied with the character 20H. Each character must be within the range 12 to 126. If the recorder detects invalid characters, they will be replaced by 20H and the negative acknowledgement will be sent as an answer.

5.3.4 Print intervals 18H

Para-meter address (offset)	Data type	Function and coding
0000H	Byte	Print intervals for text #1 00H = Off 01H = 15 min 02h = 30 min 03H = 1 h 04H = 2 h 05H = 3 h 06H = 6 h 07H = 12 h 08H = 24 h
0001H	Byte	Print intervals for text #2 as text 1
0002H	Byte	Print intervals for text #3 as text 1
0003H	Byte	Print intervals for text #4 as text 1
0004H	Byte	Print intervals for text #5 as text 1
0005H	Byte	Print intervals for text #6 as text 1
0006H	Byte	Print intervals for text #7 as text 1
0007H	Byte	Print intervals for text #8 as text 1
0008H	Byte	Print intervals for meas. val. as text 1
0009H	Byte	Print intervals for date and time as text 1

5.3.5 Synchronization times for text print 19H

Parameter address (offset)	Data type	Function and coding
0000H	Word	Synchronization time for text 1 High byte = Hour (0...23)= 00..17H Low byte = Minute (0...59)= 00..3BH
0002H	Word	Synchronization time for text 2
0004H	Word	Synchronization time for text 3
0006H	Word	Synchronization time for text 4
0008H	Word	Synchronization time for text 5
000AH	Word	Synchronization time for text 6
000CH	Word	Synchronization time for text 7
000EH	Word	Synchronization time for text 8
0010H	Word	Synchronization time for measured values
0012H	Word	Synchronization time for date and time

The synchronization times are also processed by the recorder in the 24-hour format even if the US date format is given.

5.3.6 Communication parameter 1AH

Parameter address (offset)	Data type	Function and coding
0000H	Byte	Device address 0...126 = 00..7EH
0001H	Byte	Baud rate 00H = 300 01H = 600 02H = 1200 03H = 2400 04H = 4800 05H = 9600 06H = 19200
0002H	Byte	Parity 00H = None 01H = Even 02H = Uneven
0003	Byte	Interface type 00H = RS 232C 01H = RS 485

Device address 131 (dec.) has been defined as a broadcast address. A message to address 131 (dec.) is processed by all recorders. No answer is sent to the initiator of the message.

5.3.7 Assignment of binary inputs 1BH

Offset	Type	Contents
0000H	Byte	Time marker #1 00H = Off 01H = DI1 02H = DI2 03H = DI3 04H = DI4
0001H	Byte	Time marker #2
0002H	Byte	Time marker #3
0003H	Byte	Time marker #4
0004H	Byte	Trigger printout of text line #1
0005H	Byte	Trigger printout of text line #2
0006H	Byte	Trigger printout of text line #3
0007H	Byte	Trigger printout of text line #4
0008H	Byte	Trigger printout of text line #5
0009H	Byte	Trigger printout of text line #6
000AH	Byte	Trigger printout of text line #7
000BH	Byte	Trigger printout of text line #8
000CH	Byte	Trigger printout of measured values
000DH	Byte	Trigger printout of date, time
000EH	Byte	Parameter definition enable

5.3.8 Date and time 1CH

Parameter address (offset)	Data type	Function and coding
0000H	Byte	Day 1....31 = 01..1FH
0001H	Byte	Month 1....12 = 01..0CH
0002H	Byte	Year 00...99 = 00..63H
0003H	Byte	Hour 00...23 = 00..17H
0004H	Byte	Minute 00...59 = 00..3BH

5.3.9 Table of character sets

Character	Coding [dec]	[Hexdec]
µ	12	C
π	13	D
σ	14	E
Σ	15	F
τ	16	10
Φ	17	11
Ω	18	12
Å	19	13
å	20	14
Ä	21	15
ä	22	16
Ö	23	17
ö	24	18
Ü	25	19
ü	26	1A
←	27	1B
√	28	1C
²	29	1D
£	30	1E
¥	31	1F
	32	20
!	33	21
"	34	22
#	35	23
$	36	24
%	37	25
&	38	26
'	39	27
(	40	28
)	41	29
*	42	2A
+	43	2B
,	44	2C
-	45	2D
.	46	2E
/	47	2F
0	48	30
1	49	31
2	50	32
3	51	33
4	52	34

Character	Coding [dec]	[Hexdec]
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
:	58	3A
;	59	3B
<	60	3C
=	61	3D
>	62	3E
?	63	3F
@	64	40
A	65	41
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D

Character	Coding [dec]	[Hexdec]
^	94	5E
_	95	5F
‘	96	60
a	97	61
b	98	62
c	99	63
d	100	64
e	101	65
f	102	66
g	103	67
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E

Character	Coding [dec]	[Hexdec]
o	111	6F
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B
|	124	7C
}	125	7D
~	126	7E

5.3.10 Calibration data 1DH [Data can only be read]

Parameter address (offset)	Data type	Function and coding
0000H... 0007H	Word	Blue, red, green, violet channel Chart zero line 0000...FFFF
0008H... 000FH	Word	Blue, red, green, violet channel Chart 100 % line 0000...FFFF
0010H... 0017H	Word	Blue, red, green, violet channel Input calibration start
0018H... 001FH	Word	Blue, red, green, violet channel Input calibration final value
0020H... 0027H	Word	Blue, red, green, violet channel Line resistance with Pt 100 2-wire circuit
0028H... 002FH	Word	Offset correction

5.3.11 Measured values and device status 1EH [Data can only be read]

Paramet. address (offset)	Data type	Function and Coding
0000H	Float	Measured value blue channel
0004H	Float	Measured value red channel
0008H	Float	Measured value green channel
0010H	Float	Measured value violet channel
0018H	Byte	DI status 7 6 5 4 3 2 1 0 DI2 = On DI2 = On DI3 = On DI4 = On
0019H	Byte	DO status 7 6 5 4 3 2 1 0 DO1 = On DO2 = On DO3 = On DO4 = On DO5 = On DO6 = On
001AH	Byte	External speed changeover status 0 = Input open, speed 1 is active 1 = Input closed, speed 2 is active
001B	Byte	External speed control status 0 = Input open, speed 1 or 2 active 1 = Input closed, speed off
001CH	Word	Self-test alarm status F E D C B A 9 8 7 6 5 4 3 2 1 0 CPU Int. RAM Ext. RAM Clock module Relay driver Channel card Self-test blue Self-test red Self-test green Self-test violet Read cal. EEpro. Read para. EEpro.
001EH	Word	Self-test alarm acknowledgement status Assignment of the bits as for the self-test alarm status
0020H	Word	System-alarm status F E D C B A 9 8 7 6 5 4 3 2 1 0 Checksum cal. Checksum para. Write cal. E2 Write para. E2 Watchdog reset Printer queue full Printer error Clock power failure Speed too great Input type not suit.
0022H	Word	System-alarm acknowledgement status Assignment of the bits as for the system alarm status 0 = alarm acknowledged

Continuation

Paramet. address (offset)	Data type	Function and Coding
0024H	Word	System-alarm acknowledgment status F E D C B A 9 8 7 6 5 4 3 2 1 0 Blue GW 1 Red GW 1 Green GW 1 Violet GW 1 Blue GW 2 Red GW 2 Green GW 2 Violet GW 2 Blue gradient Red gradient Green gradient Violet gradient
00264H	Word	Alarm value alarms Acknowledgement status Assignment of the bits as for alarm value alarm status Bit set = Alarm acknowledged
0028H	word	Channel card's communication Alarm status F E D C B A 9 8 7 6 5 4 3 2 1 0 ComEr. Blue ComEr. Red ComEr. Green ComEr. Viol.
002AH	Word	Channel card's communication Acknowledgement status Assignment of the bits as for the channel card communication alarm status Bit set = Alarm acknowledged
002CH	Byte	Recording systems 7 6 5 4 3 2 1 0 System green System red System blue System violet
002DH	Byte	Channel card's type 0 = Standard 1 = Universal 255 = Unknown type
002EH	Byte	DI and DO installation 0 = None 1 = Installed
002FH	Byte	Serial interface 0 = None 1 = Installed
0030H	Byte	Print head 0 = None 1 = Installed

7 Formation of text blocks

If, for example, variable parameters are to be printed at the start or end of a batch process (precondition: the printer channel has been installed in the recorder) an entire text line can be sent to the recorder with parameter group address F1H.

7.1 Send print lines to recorder

(with parameter field address F1H)

With this message a text line with 16 characters is sent to the recorder. The recorder enters the message into the printer queue. Once the queue is empty, printing of the text is immediately commenced, otherwise the text lines stored in the queue are printed first. The recorder acknowledges the message with the acknowledge code 10 h, if the message has been received error-free and has been entered into the queue. The acknowledge code 11 h is transmitted as an answer if the queue has no more free space.

The message format is:

SD2 LE LEr SD2 DA SA FC aa oo dd cc [Text line] FCS ED

I<----------L---------->I

where :

SD2 = 68H	Start byte
LE = 17H	Number of data bytes + 7
LEr = 17H	Repeat of LE
SD2 = 68H	Repeat of start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 16H	Function code
aa = F1H	Basic address of the parameter field
oo = 00H	Filler byte
dd	Date control 00H = Print text without date and time 01H = Print text with time 02H = Print text with date 03H = Print text with date and time
cc = 10H	Number of data bytes
Text line	16 ASCII characters, characters not in use must be set to 20H (space).
FCS	Checksum
ED = 16H	End code
L	Number of bytes in FCS

8. Connection of WIZCON to Minicomp MK

The function codes and parameter addresses below are for establishing a connection between Minicomp MK and WIZCON. The function codes used by the driver software "vpidc.com" are supported here.

8.1 Interrogation of 8 values

(With telegram SD3 and function code 04H)

Is used to send a query to the recorder.
The computer query sent to the recorder has the following format:

SD3 DA SA FC a1 a2 a3 a4 a5 a6 a7 a8 FCS ED

I<----------L---------->I

where :

SD3 = A2H	Start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 04H	Function code
a1...a8	Parameter addresses from Section 8.3
FCS	Checksum (sum of the Hex. values of
the	"L" Frames)
ED = 16H	End code
L	Number of bytes in FCS

The addresses permitted for a1...a8 are listed in Section 8.3 "Parameter addresses". If the same value is entered for two successive address fields, the data of the repeated address and all following data are omitted.

The recorder answer is:

SD2 LE LEr SD2 DA SA 04H value1 value2 ... value8 FCS ED

The max. 8 values correspond to the addresses entered in the query. Each value is represented by 16 bits.
The values are transmitted in the order High Byte / Low Byte.

8.2 Modification of 2 values

(With telegram SD3 and function code 07H)

The computer query is:

SD3 DA SA FC c1 a1 val1 c2 a2 val2 FCS ED

I<----------L---------->I

where :

SD3 = A2H,	Start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 07H	Function code
c1 = 01H	Triggers modification in device
a1	Parameter addresses from Section 8.3
val 1	Value of the parameter
c2 = 01H	Triggers modification in the device
a2	Parameter addresses from Section 8.3

val 2	Value of the parameter
FCS	Checksum (sum of the Hex. values of the "L" frames)
ED = 16H	End code
L	Number of bytes in FCS

c1 or c2 is the code which decides whether the value is to be actually modified. The new value is taken over by the recorder if the code is 01H or 02H.

No other value for c1 or c2 triggers an action. Parameters a1/a2 are the corresponding parameter addresses. The new values (16 bit) have been entered into the message for val1/val2, with the order High Byte/Low Byte.

The recorder answer is:

SD1 DA SA qq FCS ED.

Here qq is the acknowledge code of the recorder.
If qq = 10H, the message has been processed error-free.
The acknowledge code 11H is sent in the event of an error.

Repeat the entries for val 1 as val 2 if only one value is to be changed in the recorder (WIZCON only permits modification of one value).

8.3 Numerical formats

The analog values are transmitted in a standardized format, with scale start = 0 ‰ and scale end = 1000 ‰ being used as reference values. Hence all values possible are within the range 0 to 1000. Negative values cannot occur. The hexadecimal value assigned to a decimal per mille value is calculated as follows:

Hex value = Per mille value * 16 + 32768

Example: The measured value of a channel is 87 °C (= val) in a measuring range between
–50 °C (= low) and + 150 °C (= high).
The corresponding Hex value is calculated as:

Hex value = (val low) / (high low) * 1000 * 16+ 32768

= 0.685 * 16000 + 32768
= 43728
= **AAD0H**

Example:
Chart speed 1 = 240 mm/h --> Index = 08H (from Section 5.3.1).
The transmitted value is calculated as :
Value = Index * 16 + 32768 = 8080H.

8.4 Parameter addresses for function code 04H and 07H

The values marked with "*" can be modified with function code 07H. Here one must note that also these values are transmitted acc. to the standardized numerical format.

Parameter address	Contents
00H	Measured value blue channel (standardized)
01H	Measured value red channel (standardized)
02H	Measured value green channel (standardized)
03H	Measured value violet channel (standardized)
04H *	Chart speed index 1
05H *	Chart speed index 2
06H *	Chart speed index for external clock rate chart speed
07H *	Day of the internal-recorder clock
08H *	Month
09H *	Year
0AH *	Hour
0BH *	Minute
	Alarm values for blue measuring system
10H *	Alarm value #1 (standardized)
11H *	Alarm value #2 (standardized)
12H *	Gradient time basis (3..30)
13H *	Alarm value #1 function (0 = min., 1 = max.)
14H *	Alarm value #2 function (0 = min., 1 = max.)
15H *	Relay output for alarm value #1 (0..6)
16H *	Relay output for alarm value #2 (0..6)
17H *	Relay output for gradient (0..6)
	Alarm values for red measuring system
18H *	Alarm value #1 (standardized)
19H *	Alarm value #2 (standardized)
1AH *	Gradient time basis (3..30)
1BH *	Alarm value #1 function (0 = min., 1 = max.)
1CH *	Alarm value #2 function (0 = min., 1 = max.)
1DH *	Relay output for alarm value #1 (0..6)
1EH *	Relay output for alarm value #2 (0..6)
1FH *	Relay output for gradient (0..6)
	Alarm values for green measuring system
20H *	Alarm value #1 (standardized)
21H *	Alarm value #2 (standardized)
22H *	Gradient time basis (3..30)
23H *	Alarm value #1 function (0 = min., 1 = max.)
24H *	Alarm value #2 function (0 = min., 1 = max.)
25H *	Relay output for alarm value #1 (0..6)
26H *	Relay output for alarm value #2 (0..6)
27H *	Relay output for gradient (0..6)
	Alarm values for violet measuring system
28H *	Alarm value #1 (standardized)
29H *	Alarm value #2 (standardized)
2AH *	Gradient time basis (3..30)
2BH *	Alarm value #1 function (0 = min., 1 = max.)
2CH *	Alarm value #2 function (0 = min., 1 = max.)
2DH *	Relay output for alarm value #1 (0..6)
2EH *	Relay output for alarm value #2 (0..6)
2FH *	Relay output for gradient (0..6)

8.5 Interrogation of binary information

(with telegram SD3 and function code 05H)

Is used to send a query to the recorder. The values transmitted with function code 05 are not converted acc. to the numerical format for analog values, since the information involved here is exclusively binary information.

The recorder uses one byte in the answer message for each parameter address queried. Bits not in use are set to 0 by the recorder.

The computer's query to the recorder is:

SD3 DA SA FC aa cc xx xx xx xx xx xx FCS ED
I<----------L---------->I

where :

SD3 = A2H,	Start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 05H	Function code
aa	Start address = Parameter address (see Section 8.7)
cc	Number of data bytes
xx xx	6 arbitrary bytes
FCS	Checksum (sum of the Hex values of the "L" Frames)
ED = 16H	End code
L	Number of bytes in FCS

The recorder's answer is:

SD2 LE LEr SD2 DA SA 05H Byte 1 Byte 2 ... Byte n FCS ED

8.6 Modification of binary information

(with telegram SD3 and function code 1FH and 2FH)

Data can be written by WIZCON into the values marked with an "*" in Section 8.8. Here WIZCON uses the following function codes:
– 1FH to set a bit
– 2FH to delete a bit
The bit position to be determined in WIZCON for the gate parameter definition is not relevant for the recorder, since only one parameter is addressed with one address, and this parameter can be modified by WIZCON.

Deleting a bit
The computer's query is:

SD3 DA SA 2F a1 00 a2 00 a3 00 a4 00 FCS ED
I<----------L---------->I

where:

SD3 = A2H,	Start byte
DA	Destination address (bus subscriber address)
SA	Source address
FC = 2FH	Function code
a1	Parameter address from Section 8.7
00	Byte value
a2	Parameter address from Section 8.7
00	Byte value
a3	Parameter address from Section 8.7
00	Byte value
a4	Parameter address from Section 8.7
00	Byte value
FCS	Checksum (sum of Hex. values of the "L" Frames)
ED = 16H	End code

Number of bytes in FCS
The recorder's answer is: **SD1 DA SA qq FCS ED**.

Here qq is the acknowledgement code of the recorder. If qq = 10H, the message has been processed error-free. In the event of an error the acknowledge code 11H is transmitted. If less than 4 bytes are to be changed, repeat the last valid byte address and the associated value at the next position.

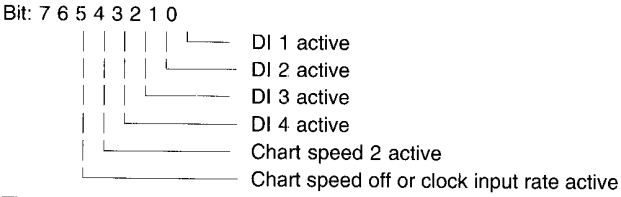
Function code 1F is used to set a bit.
Use FF as byte value.

8.7 Parameter addresses for function code 05H

Parameter address	Contents
00H	Alarm value status blue channel
01H	Alarm value status red channel
02H	Alarm value status green channel
03H	Alarm value status violet channel
04H	Status DI
05H	Status DO
06H	Self-test status High byte
07H	Self-test status Low byte
08H *	Take-up motor status (01 = running)
09H *	Recorder status (01 = recording in progress)
0AH *	Remote (01 = remote, local key entries are inhibited)
0BH	Parameter definition status (01 = recorder is in the parameter mode, modification of the parameter definition mode is not possible in via the interface)

Further explanations:
The alarm value status of the channels is stored in the lowest 3 bits of a byte.

The status of the binary inputs is stored in the lowest 6 bits of a byte.



The status of the binary outputs are stored in the lowest 6 bits of a byte.

8.8 ‰ conversion into and out of hexadecimal numbers (only for telegrams according to Sections 8.1 and 8.2)

	_0	_1	_2	_3	_4	_5	_6	_7	_8	_9
0_	8000	8010	8020	8030	8040	8050	8060	8070	8080	8090
1_	80A0	80B0	80C0	80D0	80E0	80F0	8100	8110	8120	8130
2_	8140	8150	8160	8170	8180	8190	81A0	81B0	81C0	81D0
3_	81E0	81F0	8200	8210	8220	8230	8240	8250	8260	8270
4_	8280	8290	82A0	82B0	82C0	82D0	82E0	82F0	8300	8310
5_	8320	8330	8340	8350	8360	8370	8380	8390	83A0	83B0
6_	83C0	83D0	83E0	83F0	8400	8410	8420	8430	8440	8450
7_	8460	8470	8480	8490	84A0	84B0	84C0	84D0	84E0	84F0
8_	8500	8510	8520	8530	8540	8550	8560	8570	8580	8590
9_	85A0	85B0	85C0	85D0	85E0	85F0	8600	8610	8620	8630
10_	8640	8650	8660	8670	8680	8690	86A0	86B0	86C0	86D0
11_	86E0	86F0	8700	8710	8720	8730	8740	8750	8760	8770
12_	8780	8790	87A0	87B0	87C0	87D0	87E0	87F0	8800	8810
13_	8820	8830	8840	8850	8860	8870	8880	8890	88A0	88B0
14_	88C0	88D0	88E0	88F0	8900	8910	8920	8930	8940	8950
15_	8960	8970	8980	8990	89A0	89B0	89C0	89D0	89E0	89F0
16_	8A00	8A10	8A20	8A30	8A40	8A50	8A60	8A70	8A80	8A90
17_	8AA0	8AB0	8AC0	8AD0	8AE0	8AF0	8B00	8B10	8B20	8B30
18_	8B40	8B50	8B60	8B70	8B80	8B90	8BA0	8BB0	8BC0	8BD0
19_	8BE0	8BF0	8C00	8C10	8C20	8C30	8C40	8C50	8C60	8C70
20_	8C80	8C90	8CA0	8CB0	8CC0	8CD0	8CE0	8CF0	8D00	8D10
21_	8D20	8D30	8D40	8D50	8D60	8D70	8D80	8D90	8DA0	8DB0
22_	8DC0	8DD0	8DE0	8DF0	8E00	8E10	8E20	8E30	8E40	8E50
23_	8E60	8E70	8E80	8E90	8EA0	8EB0	8EC0	8ED0	8EE0	8EF0
24_	8F00	8F10	8F20	8F30	8F40	8F50	8F60	8F70	8F80	8F90
25_	8FA0	8FB0	8FC0	8FD0	8FE0	8FF0	9000	9010	9020	9030
26_	9040	9050	9060	9070	9080	9090	90A0	90B0	90C0	90D0
27_	90E0	90F0	9100	9110	9120	9130	9140	9150	9160	9170
28_	9180	9190	91A0	91B0	91C0	91D0	91E0	91F0	9200	9210
29_	9220	9230	9240	9250	9260	9270	9280	9290	92A0	92B0
30_	92C0	92D0	92E0	92F0	9300	9310	9320	9330	9340	9350
31_	9360	9370	9380	9390	93A0	93B0	93C0	93D0	93E0	93F0
32_	9400	9410	9420	9430	9440	9450	9460	9470	9480	9490
33_	94A0	94B0	94C0	94D0	94E0	94F0	9500	9510	9520	9530
34_	9540	9550	9560	9570	9580	9590	95A0	95B0	95C0	95D0
35_	95E0	95F0	9600	9610	9620	9630	9640	9650	9660	9670
36_	9680	9690	96A0	96B0	96C0	96D0	96E0	96F0	9700	9710
37_	9720	9730	9740	9750	9760	9770	9780	9790	97A0	97B0
38_	97C0	97D0	97E0	97F0	9800	9810	9820	9830	9840	9850
39_	9860	9870	9880	9890	98A0	98B0	98C0	98D0	98E0	98F0
40_	9900	9910	9920	9930	9940	9950	9960	9970	9980	9990
41_	99A0	99B0	99C0	99D0	99E0	99F0	9A00	9A10	9A20	9A30
42_	9A40	9A50	9A60	9A70	9A80	9A90	9AA0	9AB0	9AC0	9AD0
43_	9AE0	9AF0	9B00	9B10	9B20	9B30	9B40	9B50	9B60	9B70
44_	9B80	9B90	9BA0	9BB0	9BC0	9BD0	9BE0	9BF0	9C00	9C10
45_	9C20	9C30	9C40	9C50	9C60	9C70	9C80	9C90	9CA0	9CB0
46_	9CC0	9CD0	9CE0	9CF0	9D00	9D10	9D20	9D30	9D40	9D50
47_	9D60	9D70	9D80	9D90	9DA0	9DB0	9DC0	9DD0	9DE0	9DF0
48_	9E00	9E10	9E20	9E30	9E40	9E50	9E60	9E70	9E80	9E90
49_	9EA0	9EB0	9EC0	9ED0	9EE0	9EF0	9F00	9F10	9F20	9F30

	_0	_1	_2	_3	_4	_5	_6	_7	_8	_9
50_	9F40	9F50	9F60	9F70	9F80	9F90	9FA0	9FB0	9FC0	9FD0
51_	9FE0	9FF0	A000	A010	A020	A030	A040	A050	A060	A070
52_	A080	A090	A0A0	A0B0	A0C0	A0D0	A0E0	A0F0	A100	A110
53_	A120	A130	A140	A150	A160	A170	A180	A190	A1A0	A1B0
54_	A1C0	A1D0	A1E0	A1F0	A200	A210	A220	A230	A240	A250
55_	A260	A270	A280	A290	A2A0	A2B0	A2C0	A2D0	A2E0	A2F0
56_	A300	A310	A320	A330	A340	A350	A360	A370	A380	A390
57_	A3A0	A3B0	A3C0	A3D0	A3E0	A3F0	A400	A410	A420	A430
58_	A440	A450	A460	A470	A480	A490	A4A0	A4B0	A4C0	A4D0
59_	A4E0	A4F0	A500	A510	A520	A530	A540	A550	A560	A570
60_	A580	A590	A5A0	A5B0	A5C0	A5D0	A5E0	A5F0	A600	A610
61_	A620	A630	A640	A650	A660	A670	A680	A690	A6A0	A6B0
62_	A6C0	A6D0	A6E0	A6F0	A700	A710	A720	A730	A740	A750
63_	A760	A770	A780	A790	A7A0	A7B0	A7C0	A7D0	A7E0	A7F0
64_	A800	A810	A820	A830	A840	A850	A860	A870	A880	A890
65_	A8A0	A8B0	A8C0	A8D0	A8E0	A8F0	A900	A910	A920	A930
66_	A940	A950	A960	A970	A980	A990	A9A0	A9B0	A9C0	A9D0
67_	A9E0	A9F0	AA00	AA10	AA20	AA30	AA40	AA50	AA60	AA70
68_	AA80	AA90	AAA0	AAB0	AAC0	AAD0	AAE0	AAF0	AB00	AB10
69_	AB20	AB30	AB40	AB50	AB60	AB70	AB80	AB90	ABA0	ABB0
70_	ABC0	ABD0	ABE0	ABF0	AC00	AC10	AC20	AC30	AC40	AC50
71_	AC60	AC70	AC80	AC90	ACA0	ACB0	ACC0	ACD0	ACE0	ACF0
72_	AD00	AD10	AD20	AD30	AD40	AD50	AD60	AD70	AD80	AD90
73_	ADA0	ADB0	ADC0	ADD0	ADE0	ADF0	AE00	AE10	AE20	AE30
74_	AE40	AE50	AE60	AE70	AE80	AE90	AEA0	AEB0	AEC0	AED0
75_	AEE0	AEF0	AF00	AF10	AF20	AF30	AF40	AF50	AF60	AF70
76_	AF80	AF90	AFA0	AFB0	AFC0	AFD0	AFE0	AFF0	B000	B010
77_	B020	B030	B040	B050	B060	B070	B080	B090	B0A0	B0B0
78_	B0C0	B0D0	B0E0	B0F0	B100	B110	B120	B130	B140	B150
79_	B160	B170	B180	B190	B1A0	B1B0	B1C0	B1D0	B1E0	B1F0
80_	B200	B210	B220	B230	B240	B250	B260	B270	B280	B290
81_	B2A0	B2B0	B2C0	B2D0	B2E0	B2F0	B300	B310	B320	B330
82_	B340	B350	B360	B370	B380	B390	B3A0	B3B0	B3C0	B3D0
83_	B3E0	B3F0	B400	B410	B420	B430	B440	B450	B460	B470
84_	B480	B490	B4A0	B4B0	B4C0	B4D0	B4E0	B4F0	B500	B510
85_	B520	B530	B540	B550	B560	B570	B580	B590	B5A0	B5B0
86_	B5C0	B5D0	B5E0	B5F0	B600	B610	B620	B630	B640	B650
87_	B660	B670	B680	B690	B6A0	B6B0	B6C0	B6D0	B6E0	B6F0
88_	B700	B710	B720	B730	B740	B750	B760	B770	B780	B790
89-	B7A0	B7B0	B7C0	B7D0	B7E0	B7F0	B800	B810	B820	B830
90_	B840	B850	B860	B870	B880	B890	B8A0	B8B0	B8C0	B8D0
91_	B8E0	B8F0	B900	B910	B920	B930	B940	B950	B960	B970
92_	B980	B990	B9A0	B9B0	B9C0	B9D0	B9E0	B9F0	BA00	BA10
93_	BA20	BA30	BA40	BA50	BA60	BA70	BA80	BA90	BAA0	BAB0
94_	BAC0	BAD0	BAE0	BAF0	BB00	BB10	BB20	BB30	BB40	BB50
95_	BB60	BB70	BB80	BB90	BBA0	BBB0	BBC0	BBD0	BBE0	BBF0
96_	BC00	BC10	BC20	BC30	BC40	BC50	BC60	BC70	BC80	BC90
97_	BCA0	BCB0	BCC0	BCD0	BCE0	BCF0	BD00	BD10	BD20	BD30
98_	BD40	BD50	BD60	BD70	BD80	BD90	BDA0	BDB0	BDC0	BDD0
99_	BDE0	BDF0	BE00	BE10	BE20	BE30	BE40	BE50	BE60	BE70
100_	BE80	BE90	BEA0	BEB0	BEC0	BED0	BEE0	BEF0	BF00	BF10

ABB has Sales & Customer Support expertise in over 100 countries worldwide.

www.abb.com

Printed in the Fed. Rep. of Germany (05.03)

42/43-26 EN

ABB Automation Products GmbH
Borsigstrasse 2
63755 Alzenau
Germany
Tel: +49 6023 92-0
Fax: +49 6023 92-3210