Betriebsanleitung
Operating Instructions

SC 9000

Konfigurierprogramm für R9000

Configuration program for R9000

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Edition 2

Issued by GOSSEN-METRAWATT GMBH
D-90327 Nürnberg

Company address:
Thomas-Mann-Str. 16 - 20
D-90471 Nürnberg

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1 Configuration program SC 9000

Description

The SC9000 program package permits convenient configuration and parameter setting of the R9000 control system also as of the previous control system GTR 8000. In addition, deviations of as many as 8 control zones can be displayed simultaneously and clearly. The configuration program for personal computers (IBM XT, AT or compatible computers) includes explanations in German or English.

Scope of delivery

The SC300 program package contains the following files:

- ❍ READSC9.ME
- ❍ SC9000.EXE
- ❍ SC9000.BAS

The program files are delivered on a $5^1/_4$" disk (formatted for 360 kbytes) and $3^1/_2$" disk (formatted for 720 kbytes).

Contents of the SC9000 program

1. The "READSC9.ME" describes

   - ❍ the requirements to the personal computer
   - ❍ the program structure
   - ❍ the electrical data of the interface
   - ❍ the making of the connection cable

2. By way of a possible application, the executable program "SC9000.EXE" shows the interface dialog between the control system and the personal computer. With menu-guided operation, it is possible to

   - ❍ enter configuration and control parameters
   - ❍ display parameters and values in tabular form
   - ❍ show the deviations on the bar graph display
   - ❍ store and copy parameters to disk
   - ❍ name control loops

   optionally in German or English.

   For operation, the user should be familiar with the DOS operating system. To make the interface connection, it is required to be familiar with the hardware of the personal computer.

3. The associated source program „SC9000.BAS" in MS BASIC shows the interface dialog between the controller and the personal computer. The user can tailor the program to his needs.

   Conversion into other program languages, such as C or PASCAL, is facilitated by the structured program presentation.

2 Startup

2.1 Personal computer requirements

- ❍ Personal computer IBM XT, AT or compatible.
- ❍ Operating system PC/MS-DOS, version 3.1 or higher.
- ❍ Floppy disk drive 3.5" 720 kbytes or 5.25" 360 kbytes.
- ❍ Hard disk.
- ❍ Main memory 512 kbytes.
- ❍ 1 serial interface TTY or RS 232 or
  1 serial interface RS 232 and 1 interface adapter TTY/RS 232.
  (e.g. Wiesemann & Theis Type 84000)

2.2 R9000 control system requirements

SC 9000 uses the SC1 data interface arranged at the left front of the control system next to the control panel with the transmission parameters:

- Transfer rate	2400 Bit/s
- Parity	none
- Number of data bits	8
- Number of stop bits	2

For this purpose, the device-internal DIP switches must be set as follows:

S1: 1, 7 = on, Rest = open
S2: 1, 2, 5 = on, Rest = open with RS 232 or
S2: 5 ... 8 = on, Rest = open with TTY
S101: 6 = open, Rest = on
(Also see system manual R9000, Order no. GTZ 4920 000 R0002)

2.3 Program installation

- ❍ Turn on the personal computer.
- ❍ Insert the original disk SC9000 into the floppy disk drive, e.g. A:
- ❍ Create a directory on the hard disk of the computer, e.g. C:\SC9000
- ❍ Copy all files from the disk in the floppy disk drive into the path on the hard disk, e.g. COPY A:*.* C:\SC9000*.*

2.4 Connection of the control system R9000 to the computer

See file "READSC9.ME".

3 Program Operation

3.1 Getting started

After call-up, various settings must be performed in the SC9000 program:

- ❍ Choose the directory in which the SC9000 program has been installed C:\SC9000
- ❍ Enter: SC9000
  Press the ENTER key.
- ❍ A startup window appears.
- ❍ Select the language of the menu prompting: d = German
  e = English
  Enter the desired letter.
- ❍ Select the name of the PC port to which the control system is connected: 1 = COM 1
  2 = COM 2
  Enter the desired digit.
- ❍ Enter the number of the connected controllers R9000
  (number of controller modules x4).
  Press the ENTER key.
- ❍ End the program: press the key F10.

3.2 Definitions

Data: Parameters and values that are transmitted between PC and controller
Parameter: Numeric quantity that can be read and written
Value: Numeric quantity that can be read only

1 controller has a maxim. of 32 channels whereby 1 channel corresponds to one control zone.

1 data block comprises all parameters of one channel
1 value block contains the values of all 4 channels of one control module

3.3 Program functions

The program functions can be selected from the working screen through the function keys.

- *F1 = Display of control parameters in tabulated format*
  Control parameters are displayed. The modification of values is not possible here.

- *F2 = Paramter entry, monitor data communication*
  All data of the connected control system is being displayed. Data entry is possible. Enter in close order to prevent the program from exiting the Enter mode:
  - number of the desired control channel (two digits). Press the ENTER key.
  - number of the desired control parameter (two digits). Press the ENTER key.
  - new parameter value. Press the ENTER key.

  In the lower right third of the screen surface the data requests to the control system and the controller responses are symbolically displayed.

- *F3 = Entry of configuration and parameter data*
  The more relevant controller data is displayed and can be modified comfortably
  - Select the desired box with the cursor.
  - Confirm numerical entries with the ENTER key.
  - Select configuration data with the space bar. Confirm with the ENTER key.

- *F4 = Bar graph diagram of the control deviation*
  For a group of eight control zones the control deviation, set point, actual value and alarm states are displayed. Change screen for the display of further zones. For the display of further zones press keys F6 or F7.

- *F6 = Load a parameter set*
  Attention: The previously stored data in the controller is overwritten
  Configuration and parameter data are sent from a file on the hard disk or a diskette to the connected controllers.

- *F7 = Store a parameter set*
  Configuration and parameter data of the connected control system is saved into a file on the hard disk or a floppy disk.

- *F8 = Enter names for the control loops*
  Enter desired names for the control loops.

4 Interface protocols

Transfer rate	110 ... 2400 bits/s
Parity	none (odd, even)
Number of data bits	8 (7)
Number of stop bits	2
Operating mode	half-duplex (full-duplex with TTY)
Character font	ASCII $0A_H$, $0D_H$, 20_H ... $7F_H$

Via the SC1 and SC2 interfaces, the CPU as well as the individual control modules can be addressed simultaneously through different set formats.

Meaning of the short form characters for the data formats at a time

- ❑ = Space (20_H)
- ? = ASCII character for inquiry
- <CRLF> = ASCII character for "carriage return, line feed" ($0A_H$, $0D_H$)
- <FF> = ASCII character for "form feed"
- Rxx = Control channel number 01, 02, ..., 32 (e.g.: R16)
- xx = Two-digit control channel number (e.g. 01, 02, 31) (30_H ... 39_H)
- yy = Two-digit control channel number of the first channel of the control module (e.g. 01, 05, 09) (30_H ... 39_H)
- ❑ xxx = Input of a three-digit decimal number (e.g.: 268)
- ❑ yyy = Output of a three-digit decimal number (e.g.: 048)
- DD ... D = Data block 56 ASCII characters (D1, D2 ... D56) (40_H ... $7F_H$)
- WWW = Value block 56 ASCII characters (W1, W2 ... W56) (40_H ... $7F_H$)
- qqqq = Checksum of D1 + D2 + ... + D56 and/or W1 + W2 + ... + W56 (30_H ... 46_H)
- KN = Abbreviation for parameter designation (see system manual R9000).

e.g.:	W ❑	Set point	
	L+	HIGH alarm value	
	L –	LOW alarm value	
	X ❑	Actual value (only possible on request)	
	H0...H9	Auxiliary parameter	
	K0...K9	Configuration parameter	
	G0...G8	Device-specific parameters	
	P0...P8	Actual values (in single set only)	
	NT	Single loop storage data block	(only possible on request)
	NG	Storage data block	(only possible on request)
	NF	Value block	(only possible on request)
	NP	Protocol	(only possible on request)
	NR	Parameter list	(only possible on request)

4.1 Single set

A single set contains a parameter of a defined control channel.

4.1.1 Request for a single set

Inquiry:	Rxx ❑ KN?
Response:	❑ yyy <CRLF> oder yyyy <CRLF> (bei yyyy ≤ 4000)
Response time:	with 110 bauds 1.4 s, with 2400 bauds 0.3 s

Example: Inquiry: „R08 ❑ X ❑ ?“ Response: „❑ 246 <CRLF>“ means that the control channel was asked for its actual value. Response: 246 (e.g.: °C)

4.1.2 Send a single set

Transmitted: Rxx ❑ KN ❑ xxx <CRLF>
or
Rxx ❑ KN xxxx <CRLF> (with xxxx ≤ 4000)

Example: R12 ❑ H4 ❑ 025 <CRLF> means that in control loop 12, parameter H4 (integral action time) is set to the value 25 (corresponding to 250 s). (See instruction list and description).

Attention: Within 0.1 s only one single set must be sent!

4.2 Data block

A data block contains all paramters of a selected control channel.

4.2.1 Request for a data block

With this interrogation, the parameters of a selected control channel are called up.

Inquiry: Rxx ❑ NT?

Response: S ❑ ❑ ❑ ❑ ❑ Q ❑ DD...DqqqqQ <CRLF> (71 characters)

Response time: with 110 bauds max. 7 s, with 2400 bauds max. 0.4 s.

4.2.2 Send a data block

With this interrogation, the paramters are sent to a selected control channel.

Transmitted: S ❑ ❑ ❑ ❑ ❑ Q ❑ DD...DqqqqQ <CRLF> (71 characters)
or
S 0 x x ❑ ❑ Q ❑ DD...DqqqqQ <CRLF>

Response: qqqqQ <CRLF> (7 characters)

Several blocks can be chained without a waiting time (up to 300 bauds)

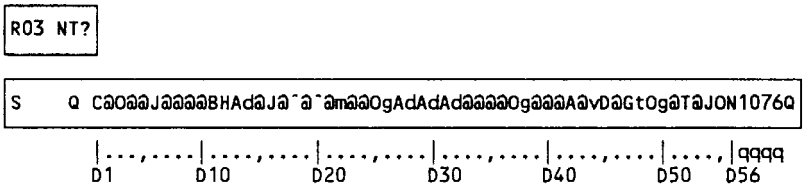
The data bytes designated "DD...D" in the data block (ASCII characters) mark the values for

- Control channel number Rxx
- Parameter K0...K9
- Parameter H0...H9
- Parameter G0...G8
- Parameter L –, L+, W

(See detailed description in section 4.5)

4.2.3 Example for a data block

Channel 3, random state here



Conversion of 2 ASCII characters into a parameter

Computation for the 3rd limit H2 (limit relative to set point with two-state controller) (see section 4.8.1) transmitted in the above example.
(2 ASCII characters „@^ “ at positions D17 and D18 in the data block)

D17 =	"@" =	40_H	→	00_H x	64 =	0 x	64 =	0
D18 =	"^" =	$5E_H$	→	$1E_H$ x	1 =	30 x	1 =	30

Display for channel number 3 on the control panel: H2 = 30

4.3 Storage data block

A storage data block is a chain of data blocks of individual control channels starting with the control channel number “Rxx” and counting down up to control channel number “R01”. The largest possible storage data block thus includes all 32 control channels.

4.3.1 Request for a storage data block via the data interface

Inquiry: Rxx ❑ NG?

Response: S ❑ ❑ ❑ ❑ ❑ Q ❑ DD ... DqqqqQ <CRLF> (71 characters) Rxx
S ❑ ❑ ❑ ❑ ❑ Q ❑ DD ... DqqqqQ <CRLF> (71 characters) R(xx-1)

•
•
•

S ❑ ❑ ❑ ❑ ❑ Q ❑ DD ... DqqqqQ <CRLF> (71 characters) R01

Response time: with 110 bauds maxi. 220 s (32 control channels),
with 2400 bauds maxi. 16 s (32 control channels).

When configuring the receiver, note that the data blocks from the control system are transmitted without time spacing between the individual data blocks.

4.3.2 Request for a storgage data block via the CBL connector

A storage data block can also be requested on the hardware side via the “CBL” connector (pin 16d) on the 32-pin edge connector of the ZE-MP circuit board. When applying this “CBL” connection (see section 5.1) of the system manual R9000) to 0 V digital for at least 0.2 s (pin 2z), the storage data block of all 32 control channels is output via the interface. By means of the switch S101 on the ZE-MP circuit board a selection can be made as to which interface (SC1 or SC2) is to send

Storage data block via SC1: 5 on
Storage data block via SC2: 5 open

4.4 Value block

4.4.1 Request for a value block

With this interrogation, the actual values from the 4 control channels of a controller are read out (values of each 4 control channnels, e.g.: 1 ... 4, 5 ... 8, 29 ... 32).

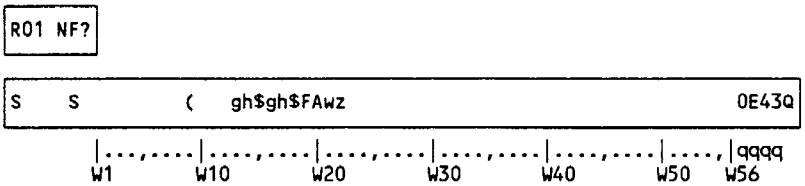
Inquiry: Ryy ❑ NF? <CRLF> (7 ... 9 characters)

Response: S ❑ ❑ ❑ ❑ ❑ S❑ WW ... WqqqqQ <CRLF> (71 characters)

(See detailed description in section 4.6).

4.4.2 Example for a value block

Channel 1, random state here



4.5 Assignment of the data block

Some parameters in the controller are inactive as a function of the configuration of the control channels.

Legend: – = not used, + = reserved for special designs

Character	Parameter	Bit	Parameters in channel mode	Values or bits = 0 / ≠ 0
D1	No	5 ... 0	Control channel number	1 ... 32
D2	*	5 ... 0	+	
D3	K0	3, 2	Control zone included in display/error scan/ protocol	
		1	Protocol line	on/off
		0	Optimization	enabled/disabled
D4	K1	3	Start-up circuitry AFS2, 2nd threshold in G0 (only together with AFS1)	no/yes
		2	Positioner with manipulated variable at 1st switching point, y-continuous; y in G3	no/yes
		1	Rapid two-state controller	no/yes
		0	Start-up circuitry AFS1, 1st (low) threshold in H2	no/yes
D5	K2	3	+	
		2	+	
		1	y-switching, y-continuous off	no/yes
		0	Control loop off	no/yes
D6	K3	3 ... 0	Input linearization: Thermocouple 0 ... 3; Pt 100 4, 5; Standard signal K3 = 10 or 11	
D7	K4	3	+	
		2	+	
		1	+	
		0	Limit signal monitor: hysteresis	symmetric/asymmetric
D8	K5	3	Multiple limit signal monitor	off/on
		2	Common set point (activated by SUW signal)	enabled/disabled
		1	Second set point (activated by EXW signal)	enabled/disabled
		0	Response delay limit contact	2 sec/10 sec
D9	K6	3	Controller type	two-state/three-state
		2	+	
		1	Switching output y	normal/inverse
		0	Response delay limit contact	same as K5/none
D10	K7	3	Unit of the controlled variable	degree C/degree F
		2	Reaction to sensor error	norm./inverse (same as x=999/=0)
		1	Limits L+, L-	relative to w/absolut e
		0	3rd limit with 2-state controller (see H2)	= max. /= min. contact
D11	K8	3	Continuous output signal with GTR9102	0 ... 20/4 ... 20mA
		2	Continuous output signal with GTR9102	normal/inverse
		1	+	
		0	+	
D12	K9	3	Input of the control action with	Tv and Tn/Tu and Tg
		2	Two-state switch (hysteresis 1 digit)	off/on
		1 ... 0	Control structure with continuous controller	0=PID, 1=PI, 2=PD, 3=P

Character	Parameter	Bit	Parameters in channel mode	Values
D13, D14	H0	11 ... 0	Control amplification	
D15, D16	H1	11 ... 0	Ratio of control amplification 2nd switching point/1st switching point	
D17, D18	H2	11 ... 0	Two-state controller; 3rd limit relative to w; three-state controller; deadband; AFS1: 1st threshold	
D19, D20	H3	11 ... 0	Delay time Tv/Tu (see K9), +	
D21, D22	H4	11 ... 0	Compensation time Tn/Tg (see K9), +	
D23, D24	H5	11 ... 0	2nd set point, enable with K5, activate with EXW signal	
D25, D26	H6	11 ... 0	Multiplication factor for display controlled variable x with standard signal input (K3 = 10 or 11)	
D27, D28	H7	11 ... 0	+	
D29, D30	H8	11 ... 0	+	
D31, D32	H9	11 ... 0	+	
D33, D34	G0	11 ... 0	Start-up circuitry AFS2: 2nd (high) threshold, +	
D35, D36	G1	11 ... 0	Storage limit signal, +	
D37, D38	G2	11 ... 0	Scaling factor for continuous output with GTR9102, +	
D39, D40	G3	11 ... 0	K1 = 4: regulation ratio y = 0..100% in G4 x 5 sec; AFS1: y in G4 x 1sec	
D41, D42	G4	11 ... 0	System sampling time (for x, y, limit contact output) in G4 x 0.4 sec	
D43, D44	G5	11 ... 0	+	
D45, D46	G6	11 ... 0	Threshold for start of self-optimization	
D47, D48	G7	11 ... 0	Threshold for start of self-optimization	
D49, D50	G8	11 ... 0	High set point limit, goes for active set point	
D51, D52	L-	11 ... 0	Low limit (min) K7: relative/absolute; K5: delay; K4: hysteresis	
D53, D54	L+	11 ... 0	High limit (max) K7: relative/absolute; K5: delay; K4: hysteresis	
D55, D56	W	11 ... 0	Set point w, active	

4.6 Assignment of the value block

Legend: – = not used, + = reserved for special designs

Channel 1

Character	Parameter	Bit	Variables	Values or bits = 0 / ≠ 0
W1, W2	X	11 ... 0	Controlled variable x	in degree/digit, without sign
W3, W4	E8	11 ... 0	+	
W5, W6	Y	11 ... 0	Regulation ratio rapid two-state controller and continuous controller GTR9102	(K1 = 2)
W7, W8	E0	11 ... 0	-	
W9	E2	5 ... 0	+	

Character	Parameter	Bit	Variables	Values or bits = 0 / ≠ 0
W10	E3	3	Sensor error	no/yes
		2	+	
		1	+	
		0	Cold junction error	no/yes
W11	E4	3	Output state: L- output	passive/active
		2	Output state: L+ output	passive/active
		1	Output state: 1st switching point-output	passive/active
		0	Output state: 2nd switching point-output	passive/active
W12, W13	E5	11 ... 0	+	
W14	E7	3 ... 0	+	

Channel 2

Character	Parameter	Bit	Variables	Values
W15, W16	X	11 ... 0	Controlled variable x	in degree/digit, without sign
W17, W18	E8	11 ... 0	+	
W19..W28			Continuous same as channel 1	

Channel 3

Character	Parameter	Bit	Variables	Values
W29, W30	X	11 ... 0	Controlled variable x	in degree/digit, without sign
W31, W32	E8	11 ... 0	+	
W33..W42			Continuous same as channel 1	

Channel 4

Character	Parameter	Bit	Variables	Values
W43, W44	X	11 ... 0	Controlled variable x	in degree/digit, without sign
W45, W46	E8	11 ... 0	+	
W47..W56			Continuous same as channel 1	

4.7 Error messages

Each transmission error detected by the central processing unit is only reported after the next valid data transmission and/or block transfer. Several consecutive, incorrect transmissions cause an error message. An error message corresponds to a reply to detected errors: ?<CRLF>

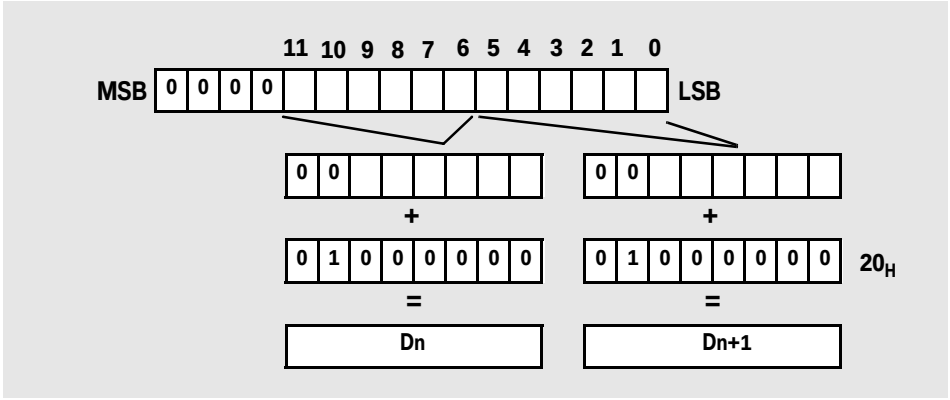
Example for incorrect transmissions

Transmitted	Response	Error with	Explanation
R34 ❑ H0?	?<CRLF>	Control channel number	maxim. permissible R32
R30 ❑ W?	?<CRLF>	Function statement	R30 ❑ W ❑ ?
R ❑ 14 ❑ L ❑+❑ 123	?<CRLF>	Transmission format	R14 ❑ L ❑+❑ 123
R01 ❑ KN?	?<CRLF>	Function statement	KN not specified
S001 ❑ ❑ Q ❑ DD ... DqqqrQ	?<CRLF>	Wrong checksum	
S ❑ ❑ ❑ ❑ ❑ Q ❑ DD ... Dqqqq –	?<CRLF>	Transmission format	Q end character missing

4.8 Coding of the data

4.8.1 Coding of an integer into 2 ASCII characters

The display parameters and quantities are internally stored as 12-bit integer without sign in the range 0 ... 4095 without decimal point. To determine the corresponding ASCII characters, the following rule applies:



or as formula:

Parameter= 64 x ($3F_H$ AND Dn)+ ($3F_H$ AND Dn+1)

Example

Set point in the data block = 100 °C

Internal presentation: 100 that is 0064_H = 0000 | 0000 | 0110 | 0100

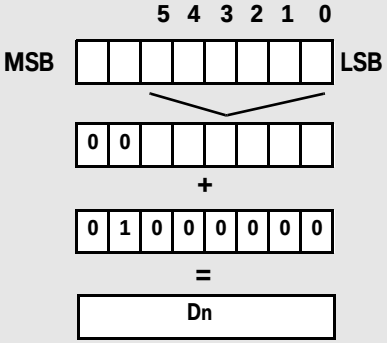
Divided into two times 6 bits:	000001	100100
Values in hex:	01_H	24_H
Plus $+40_H$ and in ASCII presentation:	41_H = 'A' = D55	64_H = 'd' = D56

Actual value of control channel 3 = 274 °C

Internal presentation: 274 d.h. 0112_H =	000100	010010
Divided into:	04_H	12_H
Plus $+40_H$ and in ASCII presentation:	44_H = 'D' = W29	52_H = 'R' = W30

4.8.2 Coding of a byte into 1 ASCII character

The status is shown in the least significant bits of the byte parameter and/or byte value.



Or as formula: parameter = ($3F_H$ AND Dn)

4.8.3 Coding of the checksum into 4 ASCII characters

The 56 ASCII characters of the data and/or value block are added. The 16 bit value thus obtained is regarded as four-digit hexadecimal number, and these four digits (0 ... 9, A ... F) are transferred as ASCII characters

Example

Let the checksum be $7803 = 1E7B_H$
then it follows qqqq = ”1”, ”E”, ”7”, ”B” = 31_H, 45_H, 37_H, 42_H

4.9 Time limits

Operation of the interface is half-duplex (full-duplex with TTY) with NRZI code. A PC or a memory-programmable controller acts as master. The control system, being slave, is ready to receive.
With the preset transfer rate of 2400 bits/s select a time interval of š 0.5 s for transfers and/or inquiries to the controllers.

If there is no response to an inquiry within one second, there is a transmission error. The cause may be a faulty connection or an incorrectly set channel number.

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GOSSEN-METRAWATT GMBH
D-90327 Nürnberg

Hausanschrift/Company address:
Thomas-Mann-Straße 16-20
D-90471 Nürnberg
Telefon (0911) 8602-0
Telefax (0911) 8602-669