Appendix

A Configuration Data

WAEBRU.INI File

This file contains parameter entries distinguishable into two types: with or without an equal sign. The parameters followed by an equal sign are specified by one or more values (separated by a blank). Parameters without an equal sign are commands in and of themselves, and can therefore only be substituted by complementary command options as prescribed in the next sections.

Lines containing commentary text are headed by a # sign. The lines thus marked have no effect on program operations and can therefore be edited, deleted, or inserted at will. Further comments can also be appended at the end of the **WAEBRU.INI** file, since the program only reads this file to the line containing the **ENDDEF** command.

```
#####################################
# File: WAEBRU.INI - Example version #
#       Version 5.00      January 93 #
#####################################
#
# Device onto which Graph-dumps shall be dumped.
#
DUMP_DEV= LPT1
#
# Device defined as standard printer.
#
PRINT_DEV= LPT1
#
# Ident. number of printer to be used.
#
PRINTER= 1
#
# Temporary files will be stored on path specified here.
#
SCRATCH=
#
# Date and time will be shown.
#
SHOWTIME
#SHOWTIME_OFF
#
# Date will be printed.
#
DATEPRINT
#DATEPRINT_OFF
#
# Default value for type of calculation (2D -> 2 or 3D -> 3).
#
DIMENSION= 2
#
# Defines the ranges of thermal conductivity to which a single color will be
# assigned in the input branch.
#
LAMBDALIMITS=   .05 .13 .14 .5  .21 .25 .9 1.2 1.5  1.8 2.1  2.5 3  20 50
#
# Defines colors (max. 15) for the different thermal conductivity ranges.
# Values between 0 and 15 shall be used (0=black).
#
LAMBDACOLORS=  8   1  9  2  10  3  11   4   12   5   13   6 14  7  15
#
```

```
# *** Default-values for grid parameters ***
#
METALSHEET= 1
FINEGRIDFROM= SPACE NOT_LAMBDA NOT_REBAR NOT_MATERIAL
LAMBDAQUOTIENT= 10.0
FINEGRIDCOAR= 2.0
FINEGRIDMIN= 5.0
FINEGRIDMAX= 100.0
FINEGRIDIGN=
#
# *** Default-values for Pseudo-color and Isotherm graphics ***
#
# Color must be chosen from a palette of 64 EGA-Card colors.
# Define up to 15 colors (influences entire screen output, including
# texts and menus).
#
TEMP_COLORS= 0 1 57 2 6 60 44 36 38 63
#
# Controlling color of Streamlines:
# 0     => compute color based on the number of the room
# 1..15 => use this color for all rooms and streamlines
#
STREAM_COLOR= 14
#
# Pseudo-Color scale will be shown.
#
COLORSCALE
#COLORSCALE_OFF
#
# Affine-distorted graph display is allowed.
#
AFFINE
#AFFINE_OFF
#
# Ratio of both screen dimensions (influences affine-distortion of display).
# May also be used to alternatively modify the ratio on printer.
#
SCREEN_X= 260
SCREEN_Y= 185
#
# Some older keyboard drivers swap definitions of Alt-Y and Alt-Z keys.
# In such a case, user must swap them back.
#
ALT_YZ_SWAP
#
# User shall be asked if graphics are to be stored onto plotfile
# (for future display with WAEBPLOT).
#
PLOT
#PLOT_ALL
#PLOT_OFF
#
# Number of grid cells shall not be calculated (potentially time consuming).
#
CELLCOUNT
#CELLCOUNT_OFF
#
#########################################################################
#
# *** Selection of output device for graphic output (WAEBPLOT) ***
#
# Ident. of screen type (graphic card).
#
SCREEN_TYP=7
#
# Ident. modifier for screen type (necessary only for some graphic cards).
#
SCREEN_TYP_AUX=0
#
# Device to which graphic output is sent.
```

```
#
PLOT_DEV= LPT1
#
# Ident. number for printer/plotter used.
#
PLOT_TYP= 15
#
PLOT_HP_TYPE= 1
PLOT_HP_INIT=
#
# Parameter to define (serial) interface with computer.
#
PLOT_BAUD= 1200
PLOT_PARITY= NONE
PLOT_STOPBIT= 1
PLOT_DATABIT= 8
#
# Recoding of color numbers (pens) from the interval 0 to 15 to device
# dependant interval. Exactly 16 values must be entered!
# Some color printers have a very large set of colors. This entry could be used
# to utilize these abilities.
#
PLOT_COLORS=0 7 8 1 9 3 2 5 4 6 0 7 0 0 4 7
#
# Parameters for various plot pens to be used. This entry applies to pen
# plotters only! Recoding of colors to pen numbers takes part at the last
# stage of color conversion (i.e. after PLOT_COLORS). All 16 colors will be
# replaced with pen numbers below. Exactly 16 values must be entered at this
# position.
#
PLOT_PEN= 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
#
# This string will be sent to print or plot device at the very beginning
# of the plot, without any interpretation (binary).
#
#PLOT_PREAMBLE=
#
# This string will be sent to print or plot device at the very end of
# each plot, without any interpretation (binary).
#
#PLOT_POSTAMBLE=
#
# Following entry instructs WAEBPLOT to use a very simple line-font.
# This could be suitable for slow pen-plotters to avoid overly time-consuming,
# graphic quality texts.
#
#PLOT_SIMPLEFONT
#
#########################################################################
#
# *** Parameters controlling calculation of optimal ***
#               relaxation factor OMEGAO
#
#
# Termination condition for determining omega:
#  if the deviation of omega from one iteration to the next is smaller
#  than OMEGAO_DELTA, then the calculation of omega is terminated.
#
OMEGAO_DELTA=0.001
#
# Maximum number of iterations for determining omega.
#
OMEGAO_STOP=60
#
# *** Parameters for defining the variation range of the ***
#                  relaxation factor OMEGA
#
#
# Initial value for omega.
# If no value is specified, this value is defined automatically (default).
```

```
#
OMEGA=
#
# Parameter for defining the minimum value of OMEGA.
# Default value OMEGA_MIN = -0.25 should not be altered!
#
OMEGA_MIN=-0.25
#
# Maximum allowable value for omega.
#
OMEGA_MAX=1.998
#
# Parameter for controlling the modification of the relaxation factor from
# one iteration to the next.
# Default value OMEGA_WEIGHT = -3 should not be altered!
#
OMEGA_WEIGHT=-3
#
# Number of iteration steps for which the maximum deviation between
# iterations shall be averaged.
#
OMEGA_TESTNUM=10
#
# Number of iterations during which OMEGA cannot be set back.
#
OMEGA_VETO=23
#
# Number of iterations in the course of post-iteration.
#
POSTRUN=15
#
# Value of the relaxation factor for post-iteration.
# (Default: OMEGA_POSTRUN = 1.0)
#
OMEGA_POSTRUN=1.0
#
# *** Parameters for defining the termination condition for the ***
#                       calculation run
#
TERM_DELTA=0.000001
#
# Lower limit for the deviation between iterations of the value calculated
# for one cell.
#
TERM_NUM=10
#
# Number of iterations for which the deviation between iterations must
# be smaller than TERM_DELTA in order to terminate calculation.
#
STOP=4000
#
# Maximum allowable number of iterations; calculation terminated after
# STOP iterations.
#
#-----------------------------------------------------------------
#
ENDDEF
#
# ENDDEF must exist!
#
After line ENDDEF - any comments desired can be entered.
These will not be used by the WAEBRU program.
```

The individual initialisation parameters of the **WAEBRU.INI** file and the various options for specification are described in the following three sections of this appendix.

A.1 Peripheral Parameters

Output Devices

DUMP_DEV=

Device interface for screen dump function.

Possible entries:

LPT1
LPT2
COM1
COM2
PRN
filename (if output should be dumped onto a file).

Example: **DUMP_DEV= LPT1**

PRINT_DEV=

Device interface for documentation and results printouts.

Possible entries: same as **DUMP_DEV**.

PRINTER=

Identification number of printer type used for printouts and screen dumps.

Possible entries (0 through 3):

0 - Epson 24 needle (LQ-2500)
1 - Epson 8/9 needle (FX-80)
2 - Epson Laser (GQ-3500)
3 - HP LaserJet +

Example: **PRINTER= 1**

PLOT_DEV=

Device interface for graphic output (output branch).

Possible entries:

LPT1
LPT2
COM1
COM2
filename

Example: **PLOT_DEV= LPT1**

PLOT_TYP=

Identification number of printer or plotter type for graphic output.

Possible entries (0 through 34):

0 - NO PRINTER OR PLOTTER
1 - C. Itoh Prowriter; NEC 8023, 8025
2 - Epson FX, RX
3 - Okidata 92, 93
4 - IBM Graphic or Professional; Epson MX; Canon BJ80
5 - Tektronix 4695 ink jet printer
6 - Toshiba P321 and P351 (unidirectional printing)
7 - Corona laser printer - requires extra 128kB memory
8 - Houston DMP-xx plotters
9 - Hewlett Packard HP-GL plotters
10 - C. Itoh 24LQ

11 - Watanabe Digi-Plot plotter
12 - Epson LQ1500
13 - Smith Corona D100
14 - Epson HI-80 plotter
15 - Hewlett Packard LaserJet+
16 - Micro Peripherals 150,180
17 - Okidata 192+ (8 bit graphics)
18 - Calcomp ColorMaster
19 - Toshiba 1340 (no unidirectional)
20 - Hewlett Packard InkJet (SW5 up) (6.5 x 8.5 in.)
21 - Roland DXY-800 plotter
22 - Toshiba P351C with colour ribbon
23 - NEC Pinwriter P series
24 - Quadram QuadLaser (with vector graphics)
25 - NEC Pinwriter P series with colour ribbon
26 - Canon LBP-811 laser printer (vector mode)
27 - 300 dpi PostScript (TM) printer
28 - Epson and compatible with 360 dpi
29 - Okidata ML 393 at 360 dpi
30 - Hewlett Packard PaintJet in colour
31 - Canon BJ-130E at 360 dpi
32 - Output Tektronix code
33 - Seikosha SK-300AI (no colour)
34 - Seikosha SK-300AI with colour ribbon

Example: **PLOT_TYP= 15**

PLOT_HP_TYP=

Only applies when **PLOT_TYP= 9**, i.e. when plotter with HP-GL language shall be used. In this case, it may be necessary to specially initialise the plotter. A parameter number entered here causes an initialisation sequence (as described below) to be sent to the plotter.

Possible entries (0 through 4):

0 - Custom (explicit) initialisation by user.

1 - Plotter type 7225A (default)

2 - Plotter type 7475A
Initialisation:
plotter on;
default buffer, no handshake, 3 wire;
Xon/Xoff; xoff with 128 bytes left,
Xon char = DC1;
no terminator; Xoff = DC3;
initialise graphics;
select pen 1; plot absolute;

3 - Plotter type 7550 A
Initialisation:
plotter on;
reset;
default buffer, no handshake, 3 wire;
Xon/Xoff; xoff with 128 bytes left,
Xon char = DC1;
no terminator; Xoff char = DC3;
initialise graphics;
select pen 1; plot absolute;

4 - Plotter types 7580B, 7585B, and 7586B
Initialisation:

```
plotter on;
reset;
default buffer, no handshake, 3 wire;
Xon/Xoff; xoff with 128 bytes left,
                    Xon char = DC1;
no terminator;   Xoff char = DC3;
initialise graphics;
select pen 1; plot absolute;
```

PLOT_HP_INIT=

User-defined initialisation sequence for PLOT_HP_TYPE= 0.

Possible entries:

ASCII characters in OCTAL form - *xxx*

(e.g. **\033** for **Escape**)

PLOT_BAUD=
PLOT_PARITY=
PLOT_STOPBIT=
PLOT_DATABIT=

Parameters defining serial interface (only for **PLOT_DEV= COM1** or **COM2**).

PLOT_BAUD= *baud rate*
Possible values:
110
150
300
600
1200
2400
4800
9600

PLOT_PARITY= *parity-bit*
Possible entries:
NONE (default)
EVEN
ODD

PLOT_STOPBIT= *number of stop-bits*
Possible values:
1 (default)
2

PLOT_DATABIT= *number of data-bits*
Possible values:
7
8 (default)

Example:

```
PLOT_DEV= COM1
PLOT_BAUD= 1200
PLOT_PARITY= NONE
PLOT_DATABIT= 8
PLOT_STOPBIT= 1
```

PLOT_COLORS=

Plot colours coded to correspond to 16 screen colours (to better utilise the colour spectrums offered by some plotters).

Possible entries: string of exactly 16 numbers, separated by single spaces.

Example: colour code for HP-PaintJet printer which corresponds closely to screen colour legend -

PLOT_COLORS= 0 7 8 1 9 3 2 5 4 6 0 7 0 0 4 7

PLOT_PEN=

Definition of transfer table between 16 output colours and associated plotter pens (0 is generally assigned to no pen). It is advisable to plot with relatively fine pens.

Example:

PLOT_PEN= 0 1 2 3 4 5 6 7 6 5 2 3 5 2 3 3

Default (in case of no entry): single-colour plot -

PLOT_PEN= 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

PLOT_PREAMBLE=
PLOT_POSTAMBLE=

Commands to be sent to plotter before and after output (adjustments) in the form of binary strings.

Possible entries: binary strings, which may also be coded in ASCII-characters - *ddd* (e.g. **\12** to cause form feed).

Example: printer in Epson LQ1500 mode is automatically switched to 10" form length during WAEBRU output - paper is advanced by 1" after output and printer then returned to original setting with

PLOT_POSTAMBLE= <**Esc**>**J**<180><**Esc**>**@**
(binary signs between <>)

or

PLOT_POSTAMBLE= \27J\180\27@

Note: In the event of output onto a file (**PLOT_DEV=** *filename*), only **PLOT_POSTAMBLE=** is still applicable; **PLOT_PREAMBLE=** has no effect.

PLOT_SIMPLEFONT

Command to use simple-font type in output graphics. This may be desirable with relatively slow plotter types in order to reduce plotting time.

Monitor

SCREEN_TYP=

Identification number for screen type to be assumed during output branch of WAEBRU; the use of a higher resolution than is standard during the rest of program operation can be specified here.

Possible entries (0 through 28):

0 - None (IBM with monochrome board)
1 - IBM colour graphics

2 - Tseng EVA/480 and NEC in 640 x 480

3 - Tecmar G M 720 x 696
configured as extended IBM mono
4 - Tecmar G M 640 x 400 configured as IBM CGA
5 - Hercules monochrome board
6 - IBM Enhanced Graphics, monochrome 640 x 350 mode
7 - IBM Enhanced Graphics, colour 640 x 350 mode
8 - TeleVideo AT 640 x 400 monochrome graphics
9 - Tecmar VGA/AD colour graphics
10 - Sigma Color 400
11 - AT&T 6300 with 640 x 400 graphics
12 - Corona (Cordata) 640 x 325 monochrome
13 - Corona (Cordata) PC400 640 x 400 monochrome
14 - Video Seven Fastwrite & V-RAM,
Tatung VGAs high resolution colour
15 - HP Vectra 640 x 480 monochrome
16 - Everex Viewpoint VGA high resolution colour
17 - VGA 640 x 480 monochrome
18 - VGY 640 x 480 colour
19 - Genoa SuperEGA HighRes 800 x 600 colour
20 - Toshiba 3100 640 x 400 monochrome
21 - AT&T Display Enhancement Board 640 x 400 colour
22 - Ahead Systems EGA Wizard/Deluxe
800 x 600 with multisync
23 - Sigma LaserView PLUS
24 - Everex EVGA 800 x 600 with multisync
25 - STB VGA Extra/EM
26 - Paradise VGA Professional, AST VGA Plus,
Hewlett Packard D1180A 800 x 600 colour
27 - VEGA Deluxe EGA 640 x 480 with multisync
28 - ATI VGA Wonder 800 x 600 with multisync

Default: EGA colour monitor, i.e. **SCREEN_TYP= 7** (relevant only for output branch!).

SCREEN_TYP_AUX=

Operating resolution mode for multiresolution screens during output branch; applies to **SCREEN_TYP= 9**, **14**, **16**, and **25** as specified below.

Possible entries: 0 or 1, depending on screen type -

SCREEN_TYP= 9 (Tecmar VGA/AD colour graphics)
SCREEN_TYP_AUX= 0 - 1024 x 768
1 - 800 x 600

SCREEN_TYP= 14 (Video Seven Fastwrite V-RAM, Tatung VGAs high resol. colour)
SCREEN_TYP_AUX= 0 - 1024 x 768
1 - 800 x 600

SCREEN_TYP= 16 (Everex Viewpoint VGA)
SCREEN_TYP_AUX= 0 - 1024 x 768
1 - 800 x 600

SCREEN_TYP= 25 (STB VGA Extra/EM)
SCREEN_TYP_AUX= 0 - 1024 x 768 interlaced
1 - 800 x 600

For all other screen types, **SCREEN_TYP_AUX=** must be set to 0.

A.2 Program Parameters

General

SCRATCH=

Drive and path of directory for temporary files during program operation.

Example: **SCRATCH= D:\TEMP**

Default: operating directory.

ALT_YZ_SWAP

Command to exchange x/y assignment of the key combinations **Alt-X** and **Alt-Y** (only necessary in the event that a misinterpretation by WAEBRU should occur due to keyboard driver and operating system).

SHOWTIME
SHOWTIME_OFF

Running time either displayed on screen during program operation (**SHOWTIME**) or suppressed (**SHOWTIME_OFF**).

Example: **SHOWTIME** (on)

DATEPRINT
DATEPRINT_OFF

Date and time of output to be either included (**DATEPRINT**) or omitted (**DATEPRINT_OFF**) in header of printouts.

Example: **DATEPRINT** (on)

DIMENSION=

Dimensional mode to be assumed (default) when no dimension has been specified in execution command.

Possible entries: **2** or **3**.

Example: two-dimensional mode -
DIMENSION= 2

Input

LAMBDALIMITS=
LAMBDACOLORS=

Definition of 14 conductivity ranges and assignment screen colours.

Possible values:

LAMBDALIMITS= - series of 14 numeric limits (range borders) of thermal conductivity [$Wm^{-1}K^{-1}$], in increasing order, separated by blanks.

LAMBDACOLORS= - series of 15 colour identification numbers (16 possible values - see below), in the order that they shall be assigned to the ranges defined by **LAMBDALIMITS** (separated by blanks).

- **0** - black
- **1** - blue
- **2** - green

3 - cobalt blue
4 - red
5 - purple
6 - brown
7 - light grey
8 - dark grey
9 - light blue
10 - light green
11 - light cobalt blue
12 - light red
13 - light purple
14 - yellow
15 - white

Example:

```
LAMBDALIMITS= .05 .1 .3 .5 .7 .9 1.2 1.5 1.8 2.1 2.5 3 10 50
LAMBDACOLORS= 8 1 9 2 10 3 11 4 12 5 13 6 14 7 15
```

Colours and corresponding conductivity ranges -

8	00.00 - 00.05
1	00.05 - 00.10
9	00.10 - 00.30
2	00.30 - 00.50
10	00.50 - 00.70
3	00.70 - 00.90
11	00.90 - 01.20
4	01.20 - 01.50
12	01.50 - 01.80
5	01.80 - 02.10
13	02.10 - 02.50
6	02.50 - 03.00
14	03.00 - 10.00
7	10.00 - 50.00
15	50.00 -

METALSHEET=

Standard thickness [mm] of theoretical metal sheet (reinforcing bar simulation) for 2-D gridding model.

Example: **METALSHEET= 1**

FINEGRIDFROM=

Definition of standard Y/N settings of fine grid parameters for **Space bound.**, **Lambda quot.**, **Rebar bound.**, and **Supp. at mat.** (see section on **Fine Grid Parameters**, Chapter 2.3)

Possible entries: separated by spaces -

SPACE (Y)	or	**NOT_SPACE** (N)
LAMBDA (Y)	or	**NOT_LAMBDA** (N)
REBAR (Y)	or	**NOT_REBAR** (N)
MATERIAL (Y)	or	**NOT_MATERIAL** (N)

Example:

```
FINEGRIDFROM= SPACE NOT_LAMBDA NOT_REBAR NOT_MATERIAL
```

LAMBDAQUOTIENT=

Standard value of lambda quotient limit, **Lim.** (see also **Fine Grid Parameters**).

Example: **`LAMBDAQUOTIENT= 10.0`**

FINEGRIDCOAR=

Standard value of fine grid coarsening factor, **Coar.**

Example: **FINEGRIDCOAR= 2.0**

FINEGRIDMIN=

Standard value of initial thickness for fine gridding, **Init. thickness** [mm].

Example: **FINEGRIDMIN= 5.0**

FINEGRIDMAX=

Standard value of maximum grid layer thickness, **Max. thickness** [mm].

Example: **FINEGRIDMAX= 100.0**

FINEGRIDIGN=

Standard entry for fine grid parameter **Ignore XYZ**.

Possible entries:
X
Y
Z

Example: **FINEGRIDIGN= X**

Evaluation and Output

TEMP_COLORS

Colour selection for temperature legend (pseudo-colour).

Possible entries: series of a maximum of 16 colour identification numbers (values 0 through 63), in order of increasing temperature; first number defines background colour.

Example:
TEMP_COLORS= 0 1 57 2 6 60 44 36 38 63

STREAM_COLORS

Colour selection for display of heat flow lines (can be specified instead of automatic selection by WAEBRU, which is dependant on room number).

Possible entries: single value (1 through 15).

Default (**STREAM_COLORS= 0** or parameter omitted):
automatic program selection.

COLORSCALE
COLORSCALE_OFF

Standard initial setting for temperature colour legend with pseudo-colour graphs and isotherms (on/off).

Example: **COLORSCALE** (on)

AFFINE
AFFINE_OFF

Standard initial setting for graph display (affine distortion on/off)

Example: **AFFINE** (on)

SCREEN_X=
SCREEN_Y=

Dimensions [mm] for graph dump (taken from either screen or dump output).

This can be used to tailor printer data to produce undistorted graph dumps as follows:

> Before changing the values entered here, generate a graph (without colour legend) in the evaluation branch of WAEBRU. Dump the screen display of this graph on the printer with Alt-P and measure the width (x) and height (y) of the printed graph image Enter these values [mm] for SCREEN_X= AND SCREEN_Y, respectively.

If the screen image, rather than the printed graph, should remain undistorted, measure and enter screen width and height here instead.

Example:

```
SCREEN_X= 260
SCREEN_Y= 185
```

PLOT
PLOT_ALL
PLOT_OFF

PLOT causes a message to appear each time a graph is generated, asking the user if the current graph shall be written onto a plotfile.

PLOT_ALL results in the automatic storing of all evaluation graphs in a plotfile. Though convenient, this option could lead to extremely extensive plotfiles.

PLOT_OFF de-activates the option of generating plotfiles altogether (thereby eliminating the possibility of executing the output branch of WAEBRU for producing high resolution graphics).

CELLCOUNT
CELLCOUNT_OFF

Defines whether or not the number of balanced cells is computed and included in evaluation results output (on/off).

Example: when considering large calculation models, potentially tedious cell counts can be skipped by activating

```
CELLCOUNT_OFF
```

(the line reading **CELLCOUNT** must then be either deleted or de-activated with a # in the first column).

A.3 Calculation Parameters for Relaxation Method

See also the section on **Numerical Solution**, Chapter 1.2.

Controlling Calculation of the Optimal Relaxation Factor

These parameters influence the preliminary calculation of an optimal relaxation factor, ω_0. It is strongly suggested that the values included in the example version of **WAEBRU.INI** not be changed.

OMEGA=_DELTA=

Termination condition for conclusion of omega calculation: limit of results deviation between iterations.

Example: **OMEGAO_DELTA=0.001**

OMEGAO_STOP

Maximum number of iterations performed for omega calculation before moving on to solution of equation system.

Example: **OMEGAO_STOP=60**

Defining Variation Range for Omega

Changes in the parameters values suggested here may negatively affect the convergence behaviour of the numerical solution method, and should therefore be avoided.

OMEGA=

Initial operating value of ω.

Example: **OMEGA=1.5**

Default (**OMEGA=**): automatic definition by program.

OMEGA_MIN=

Factor in determining minimum value of ω. Do not change!

Example (default): **OMEGA_MIN=-0.25**

OMEGA_MAX=

Maximum allowable value of ω. The entry here must be smaller than 2.

Example: **OMEGA_MAX=1.998**

OMEGA_WEIGHT=

Parameter controlling the adjustment of ω between iterations. Do not change!

Example (default): **OMEGA_WEIGHT=-3**

OMEGA_TESTNUM=

Number of iterations for which the mean of results deviations are taken (comparison value).

Example: **OMEGA_TESTNUM=10**

OMEGA_VETO=

Minimum number of iterations performed before the operating value of ω is set back.

Example: **OMEGA_VETO=23**

POSTRUN=

Number of iterations performed in post-calculation, "smoothing" procedure.

Example: **POSTRUN=15**

OMEGA_POSTRUN=

Operating value of ω for post-calculation iterations.

Example (default - do not change!): **OMEGA_POSTRUN=1.0**

Defining the Termination Conditions

Parameters which must be satisfied for a calculation case to be considered solved.

TERM_DELTA=

Standard value of the termination condition (can be changed using the option **Parameters of Iter.** from the Main Menu): lower limit of results deviation between iterations.

Example: **TERM_DELTA=0.000001**

TERM_NUM=

Number of successive iterations for which the results deviation must satisfy the termination condition before calculation is terminated and considered solved.

Example: **TERM_NUM=10**

STOP=

Maximum number of iterations performed in a single calculation run (can be changed using the option **Parameters of Iter.** from the Main Menu).

Example: **STOP=4000**

ENDDEF

Command line signifying the end of parameter specification; any lines following this command are ignored by the program.

B List of Terms and Units

B.1 Input Data

Geometry

Pertaining to the geometric model:

element	rectangular base unit of model - x and y coordinates [mm]
component	of one or more elements
group	of one or more components
aggregate	composite unit of model

Material

Pertaining to a single element:

type	material (M) heat source (H) reinforcing bar - axial (B) reinforcing bar - diagonal (D) space (S)
number	of material/rebar/space in respective table
lambda (λ)	thermal conductivity [W m^{-1} K^{-1}]
alpha (α)	surface transfer coefficient [W m^{-2} K^{-1}]

Grid

Pertaining to grid structure:

minimal grid	defined by geometry of aggregate
fine grid parameters:	
space boundaries	reference planes for gridding - y or n (yes or no)
lambda quotient (boundaries)	reference planes for gridding - y or n (yes or no)
(lambda quotient) limit	defining condition of boundaries with respect to conductivity quotient - dimensionless factor.

initial thickness	distance between first grid planes generated [mm] at reference boundaries
coarsening	factor by which distance between grid planes generated is successively increased - dimensionless
maximum thickness	maximum distance between two planes of fine grid structure [mm]
rebar boundaries	optional reference planes for automatic supplemental gridding - y or n (yes or no)
supplement at material (boundaries)	optional reference planes for automatic supplemental gridding - y or n (yes or no)
supplement grid plane	position along reference axis - x, y, or z coordinate [mm]

Parameters of Calculation

termination condition	lower limit of iteration results deviation - typically 10^{-6}
max. no. of iterations	upper limit of iterations performed in a single calculation run - typically 4000

Conditions of Evaluation

temperature	of air space (case number) [°C]
power	of heat source (case number): 2D - [W/m] 3D - [W]

Evaluation Graphs

See the section on **Evaluation Branch** in Appendix C - **List of Key Functions**.

B.2 Output Data

Numeric

conductance matrix	matrix of space-connecting thermal conductances - 2D: [$Wm^{-1}K^{-1}$] 3D: [WK^{-1}]
heat source distribution	table of factors describing distribution of heat from a source among the spaces - dimensionless
close-up error	of base solution - measure of precision for numeric solution
temperature extremes	surface temperature maximum and minimum under given conditions in each space [°C]
dewpoint	humdity level for coldest surface point at which condensation would occur [%]
weighting factors	for temperatures of all model spaces (to attain resultant temperature at a given point along surface of or within material component) - dimensionless
coldest surface point	position of the temperature minimum along component surface - x, y, (z) coordinates [mm]

Graphic

See the section on **Evaluation Branch** in Appendix C.

C List of Key Functions

The following is a brief summary of the operations assigned to particular keys and key combinations in WAEBRU. Since the functions of certain keys vary according to the section of the program package in which they are used, generally applicable key functions are presented here first, followed by the operations specific to particular parts of the program. These are listed by program section.

C.1 General

The use of keys and key functions described here are applicable within the entire program package WAEBRU. Specific key function groups are also listed here according to type of operation (menus, fields, etc.).

Alt-P	Print screen contents (graph-dump).
Alt-0 (zero)	Call up operating system (shell).
Esc	End operation or cancel current field input.
F1	Call up on-line help.
F9	Confirm input and proceed to next step of operation.
F10	Return to Main Menu or end program.

Menus

Menus are used to activate functions as well as to select data.

↑/↓	Move cursor to mark next line up/down.
Home/End	Move cursor to mark first/last line.
(*first char.).*	Mark line beginning with this character.
Enter	Confirm and run marked menu operation.
Alt-(*first char*.)	Select and run menu operation beginning with this character.

Input Fields

Input fields are used for entering as well as for editing required data.

Bksp	Move cursor one position to the left and delete (backspace).
Del	Delete character at cursor location.
Ins	Toggle Insert Mode on/off.
←/→	Move cursor one position to the left/right.
Ctrl-←/→	Tab to next/previous word (character strings separated by a space).
Home/End	Cursor to beginning/end of field.
Ctrl-Enter	Delete entire field contents.
Ctrl-R	Recover previous contents of a changed field.
↑/↓	Move cursor to previous/next field in window.
Ctrl-Home/End	Move cursor to first/last field in window.
Enter	Enter and close field input or move to next field.
F9	Confirm and close field input operation.
Esc	Cancel input field changes in current window.

File Survey

The header field of this screen asks for the input of a file name (wildcard sequences using '?' or '*' are also acceptable) as well as the number of dimensions (or '?') when a change to the suggested dimension setting is desired. The rest of the screen displays a list of existing files which apply to the dimension parameter set above. A particular existing file can be simply selected by moving the cursor position to mark the desired file name in the list and entering.

Tab	Move cursor into file list beneath header fields.
↑/↓ Home/End	Move cursor to mark desired line of file list.
PgUp/PgDn	Scroll backward/forward one window in the list.
Enter	Enter selection of marked file name.
Esc	Move cursor back to header fields without selection from the list.

Lists and Tables

↑/↓	Move cursor to mark previous/next line.
Home/End	Move cursor to mark first/last line.
PgUp/PgDn	Scroll backward/forward one window.
(*first char.*)	Move cursor to mark line beginning with this character.
Enter	Enter selection of the line marked by cursor position.
Alt-D	Delete the line currently marked.

C.2 Model Input Branch

The functions listed in this section can be implemented while working within the main screen of the input branch.

PgUp/PgDn	Move to previous/next element.
Ctrl-PgUp/PgDn	Move to previous/next building component.
F3/F4	Move to previous/next component group.
Alt-V	Call up the Display Menu ('view').
Alt-M	Enter or revise table listing.
Alt-A	Add new entry to table.
Alt-F	Call up the File Menu.
Alt-I	Toggle between Edit/Insert Modes.
Alt-C	Call up Copy Menu.
Alt-D	Delete current element.
Alt-N	Move cursor into header fields ('name').
Alt-G	Call up Grid Menu.
Alt-T	Call up Project Description window ('text').
Alt-R	Call up Reposition Menu.
Alt-X	Call up Insert/Delete Menu.
F2	Call up table listings (see 2.1.4 for further operations).
F10	End input branch. If model input has been completed, return to Main Menu.

C.3 Evaluation Branch

F10	Return to Main menu.
Alt-M	Skip directly to the evaluation of conductance matrices (when seeking only the results which are independent of boundary conditions).

Boundary Conditions

Enter F9	Confirm input and return to Evaluation Menu.

Surface Temperature - 2D

↑/↓ PgUp/PgDn	Move cursor and scroll in the space lists.
Alt-I	Invert the orientation of axes.
Alt-B	Move into boundary condition input fields.
Enter	Generate graph of temperature curve.
Esc	Return to Evaluation Menu.
F2	Display current surface region in section.
F4	Toggle between Space/Sub-space Modes.

Temperature Along an Edge - 3D

Alt-B	Move into boundary condition input fields.
Alt-X/Y/Z	Specify coordinate axis of orientation.
Enter F9	Generate graph of temperature curve.
Esc	Return to Evaluation Menu.
F2	Call up coordinate selection list (see 2.1.4 for further operations).

Isotherms/Pseudo-colour Graph

↑/↓ PgUp/PgDn	Move cursor and scroll in the coordinate lists.
Alt-X/Y/Z	Specify coordinate axis of orientation.
Alt-1/2	Reverse direction of the first/second graph axis.
Enter F9	Generate graph (F9 applies only to isotherms).
Esc	Return to Evaluation Menu.
F4	Invert axes about the graph origin.
Alt-A	Toggle affine distortion on/off.
Ctrl-F	Toggle pseudo-colour scale display on/off.
Alt-B	Move into boundary condition input fields.
Alt-V	Remove screen display of input field window (reappears as soon as any key is pressed; applies only to isotherms).

Heat Flow Diagram - 2D

↑/↓ PgUp/PgDn	Move cursor and scroll in surface region lists.
Alt-A	Toggle affine distortion on/off.
Alt-C	Delete heat flow lines (clear graph).
Ctrl-F	Toggle screen space reserved for pseudo-colour scale on/off (scale not actually displayed here).
Alt-B	Move into boundary condition input fields.
Alt-V	Remove screen display of region list window (reappears as soon as any key is pressed).
Enter	Activate input field at cursor location (blinking cursor) and deactivate by confirming input (cursor stops blinking).
Esc	Return to Evaluation Menu.
F2	Display current surface region in section.

F9	Generate heat flow diagram.

C.4 Graphic Output Branch

PgUp/PgDn		Scroll in the graph list.
?		Help
S		Select a particular graph (by entering number at subsequent input cursor).
V		Generate graph on screen only (preview).
P		Print/plot graph on output device.
D		Delete a graph from the list (by entering number at subsequent input cursor).
E	**F10**	Return to Main Menu.