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1. Fundamentals

1.1. Introduction to the controller

Introduction:

- The Multibend 9000 microcomputer controller was specially developed for RAS folding machines.
- State-of-the-art 32-bit microprocessor technology in combination with user friendly software gives you a wide range of new options.
  While developing the controller we placed great emphasis on ease of use so that no specialist (programmer or technician) is required when you enter programs.
- Soft keys, a windowing user environment and user information system support the user during input.
- Soft keys make the controller clearly organised, as just 10 soft keys cover functions otherwise requiring some 150 pushbuttons. The soft key assignments change according to the current input context.
- The entered values are checked for validity in order to prevent false inputs.
- Each program line can contain the following inputs:
  - bending angle
  - backstop position
  - upper beam downward stroke (clamp)
  - upper beam upward stroke (release)
  - bending beam adjustment
  - lower beam adjustment
  - auxiliary functions
  - user comments
  - angle correction (line-specific)
- You can select up to 20 different auxiliary functions in each program line.
- The main memory of the CNC controller holds up to 40 program lines, providing for enough inputs to accommodate your workpieces including subroutines.
- A "soft key typewriter" lets you enter text, such as program-related or line-related information.

- Extensive program information with schedule planning can be appended to the program like a work plan.
- For each bending program you can specify the tool configuration for the upper, lower and bending beams. This data is saved with the bending program.
- A tool manager manages up to 15 upper, 5 lower and 10 bending beam tool sets with graphical representations. The controller calculates the ideal tool length and position in dialogue with the user.
- You can specify individual parameter data such as speed, pressure and resilience constants for each bending program.
- The current program line is zoomed on the display, with the following information displayed to help the user during programming:

"INACTIVE" — If no backstop position has been entered. (The backstop runs to its maximum position and lowers the backstop flaps.)

"INFO LINE" — Lines that are not used during execution (e.g. developed lengths or notching dimensions)

"PROGRAM END" — Empty lines indicate the end of the program.

- Accidentally deleted values can be restored using the UNDO key as long as you have not moved the cursor.
- A calculator option can be selected to help with programming. It accepts program values and can insert the results into the appropriate program line.
- Variable programs save you having to enter the entire program. Without doing any programming, you can use default programs to produce parts with similar shapes. The user enters the drawing data in dialogue with the controller.
- 70 programs, program parameters and items of program information can be saved to a single 3.5" diskette.
- Data can be transferred to a PC running MS-DOS. You can also program externally on the PC using a software package available from RAS.

Features and terminology:

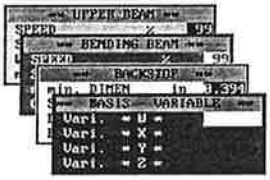
Soft keys

Soft keys are function keys whose assignments change continuously depending on the input context. There are four different kinds of soft keys:

green soft key	:	Foreground function key
pink soft key	:	Background function key Select using the NEXT key
cyan soft key	:	Additional function keys depending on the cursor position in the input level.
blue soft key	:	Exit the current level.

The soft keys appear at the bottom of the screen above the buttons. The button's function corresponds to the displayed soft key.
Soft keys F1 - F10 are located directly below the screen.

Screen windows

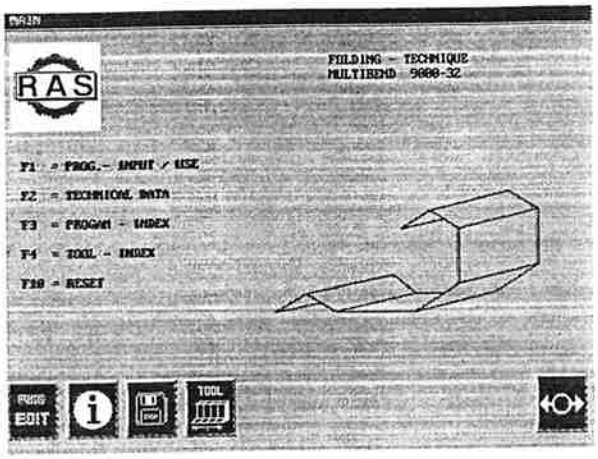


A distinction is made between display, input and tool windows.

- The display window informs you about various states.
- The input window lets you enter program lines or parameter data.
- Tool windows are auxiliary functions that pop up, such as the calculator or typewriter.

This method of program input is simple and clear, as only the information required for the current situation is requested.

Main menu

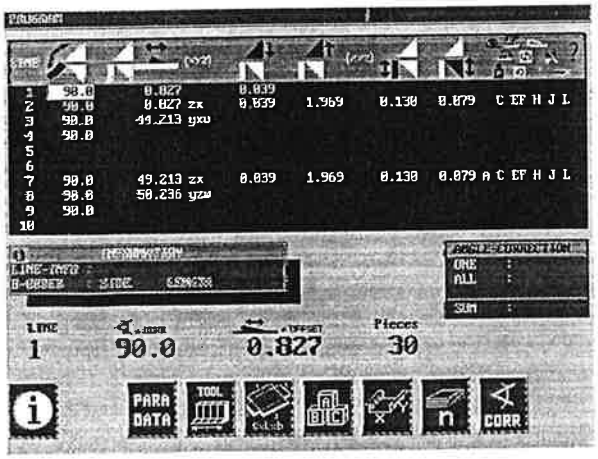


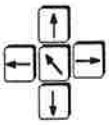
From the main menu you can select the various modes of operation. Messages and soft keys point out further relevant screens to the user.

Changing from one mode to another is always done via the main menu.

Select the main menu by pressing the  key (see section 1.3).

Editor





A set of cursor keys (the cursor is the light input mark) for UP, DOWN, LEFT, RIGHT and HOME (cursor jumps to the top left of the screen) allow simple input in connection with JUMP, MARK, COPY and MOVE functions (see 5.1.2).

Auto Clear

The Auto Clear function means that you don't need to clear an existing value to enter a new value. Simply enter the new value on the 10-key pad, and it is immediately inserted in the program line (see 5.1.4 Auto Clear).

Auto Save

Every value you enter is permanently saved, i.e. after entering a value, you need not confirm it with the 

key.

The foreground memory (working memory) is also a non-volatile memory. All program lines, parameters, Save parameters and information are retained even when the controller is switched off.

Parameters

Parameters are variables with which you can specify the speed of the bending beam and upper beam, for example, or define the safety limits.

IMPORTANT: Before running the program, check the parameter values and correct if necessary.

The parameters are assigned to the program and are automatically saved to disk when the program is saved.

Diskette

Diskettes are exchangeable storage media that are used to save programs, parameters and program information (see 11.1 Working with diskettes).

DIR = Directory

Shows you the contents, or directory, of a diskette. This directory is read automatically when you enter the manager menu (see 11.1.2 Reading the diskette directory).

UNDO

You can restore accidentally deleted values (i.e. "undo" the deletion) as long as you have **not** moved the cursor since the deletion (see 5.1.5 Restoring deleted values).

Cursor = the screen pointer used for input

A cursor is a bright mark that you move around the screen to indicate which character the current editing operation is to affect (see 5.1.2 Moving the cursor).

Insert

Insert a new line between existing lines (see.5.2.2 Insert line).

Delete

Delete lines (see 5.2.3 Delete line)

Mark

Mark a block consisting of several lines. The block can then be copied or moved (see 5.2.6 Mark block).

Copy

Copy (duplicate) a marked block (see 5.2.7 Copy block).

Move

Move (relocate) a marked block to another part of the program (see 5.2.8 Move block).

DNC

Data transfer from the machine to an external PC or vice versa.

1.2. Technical specifications (microcomputer controller)

- This controller is equipped with a NATIONAL 32-bit microprocessor, allowing the latest technology in folding machine control.
- The basic version of the controller is configured for 6 digital axes:
  - Upper beam with 2 separate displacement measuring systems.
  - Bending beam from 0 - 180°.
  - Backstop adjustment from 0.394 to 61.024 inch (10 - 1550 mm) (standard) and up to 159.449 inch (4050 mm) in special versions.
  - Bending beam adjustment from 0 to 3.150 inch (0 - 80.0 mm).
  - Lower beam adjustment (optional).
- In the standard version, the controller has a serial RA 232 C (V24) interface. The transmission rats is 9.600 baud and the effective range is 100 feet (30 m). This Interface is used for printer or data transfer.
- An RS 422 interface is available as an optional extra, with a transmission rate of 128.000 baud and a range of 0.62 miles (1 km). The same connector includes a second interface, which can be an RS 232 C (V24) or RS 422 at 9.600 baud.
- The programs can be saved to 3.5" diskettes. The capacity is:
  - 70 programs, each with
    - up to 40 program lines,
    - 16 parameters,
    - 24 program information lines,
    - and the tool configuration data for the upper, lower and bending beams.
  - It can also hold:
    - 30 tool sets,
    - 115 Save parameter data items

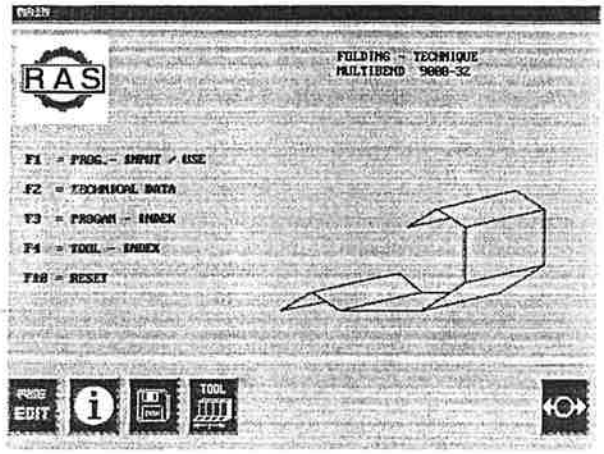
    depending on the program.
- The controller is equipped with 2 battery backed 8x32k RAMs which retain the stored values when the controller is switched off (main memory). These RAM modules hold the following data:
  - 40 program input lines
  - 16 parameters (program-related)

- 30 tool sets
- 115 Save parameters
- 24 lines of program information
- the current tool configuration of the machine.

These RAMs have an integrated battery with a charge life of about 5 years.

ATTENTION: For safety reasons you should replace the battery RAM modules after about 3 years. Please consult our customer service department.

1.3. Menu options (main menu)

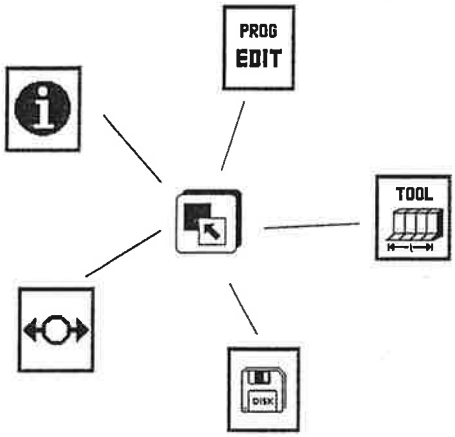


After completing the calibration procedure (see section 4.2), the main menu appears on the screen.

From the main menu you can select various modes. To change from one mode to another, you must first return to the main menu by pressing the  key.

At the bottom of the screen you will see the following mode icons. Select the desired mode using function keys F1 - F10 directly below the screen.

The following schematic illustrates the star-shaped arrangement of modes and its sublevels. The main menu is the centre of this arrangement.



Overview of the various modes

Program input

This level is for:

- entering complete bending programs (see 6. Program input).
- entering program information (see 6.4 Entering program information).
- running complete bending programs and individual program lines (see 8. Running programs).

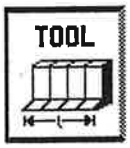
Technical specifications

This level holds all machine-specific data.

Program management

Here you can save, load and search for programs, and format diskettes (see 11. Program management).

Tool management



Here you can store and manage

- 15 upper beam
- 10 bending beam and
- 5 lower beam tool sets (see 9. Tool management).

Calibration

In this menu you can calibrate the axes of the machine (see 4.2 Calibration).

Note: After selecting the  level, you must complete the calibration procedure. You cannot abort calibration once started (see 4.2 Calibration).

2. Safety rules

Do not connect the machine to its power source or switch it on until you have read and understood the enclosed operating manual (mechanical) for RAS 74.20-40.

IMPORTANT: Chapters 2.1 - 2.4 of the separately enclosed machine operator's manual contain the complete safety regulations and must be thoroughly read and understood.

2.1. Work safety symbol

This symbol accompanies all important safety notices in this operating manual which concern personal safety. Please follow these notices and exercise particular care in such cases. All users must be familiar with the work safety notices. Besides the information in this operating manual, observe the general accident prevention regulations applicable in your country.

2.2. Attention signs

ATTENTION: This "ATTENTION" sign is found in parts of this operating manual that you should pay special attention to so that you can be sure you are following all guidelines, regulations, instructions and correct working procedures, and are preventing damage to the machine and/or other equipment.

Notes:

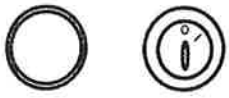
3. Overview of buttons and soft key functions

3.1. Power buttons and switches

Main switch

The main switch of the machine is on the back end of the switch cabinet, which is mounted on the right-hand side stand. It is used to connect the power supply and switch on the electronics.

Control on



This key-operated switch activates the controller (power). The white lamp to the left of the button lights up as confirmation.

Important: "RUN" control system checks the functions of the microprocessor of the CNC controller. If the processor is not functioning correctly, the power cannot be connected.

Control off

This red pushbutton switches off the electrical control system. It also interrupts any running program in the CNC controller. The controller automatically changes to

(also in input mode).

Emergency stop

After pressing this red mushroom switch, all motion is halted immediately, i.e. power is disconnected. The controller automatically changes to 

and remains activated. Input mode is activated.

In accordance with insurance regulations, the button has an interlock which is activated when the button is pressed. The interlock is unlocked by turning the knob anti-clockwise.
After unlocking the emergency switch, reconnect power by turning the key-operated switch.
Pay attention to the messages on the screen.

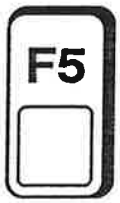
Notes:

3.2. Buttons

Main menu

Selects the main menu, from which you can change to a different mode (see 1.3 Menu options). You must also use this button to exit typewriter mode (see 5.3 Typewriter).

Function keys (soft keys)



The function keys F1 - F10 are keys with variable assignments (soft keys). The current assignment is indicated by the icons at the bottom of the screen. If there is no icon or the icon is blank, the key has no function (see 3.3 Soft keys).

Next

This button switches over to a different soft key assignment. The soft keys in the background level are shown in pink (see e.g. 5.2.2 Insert line).

Calculator

This button pops up the calculator window, which is available from any control menu. When the calculator is active, the button flashes (see also 5.5 Calculator).

Decrement

This button lets you decrement the value under the cursor by one unit. For example, from 3.937 to 3.936 (100.0 to 99.9).

Increment

This button lets you increment the value under the cursor by one unit. For example, 3.937 to 3.938 (100.0 to 100.1).

Undo

This button restores deleted values as long as you have **not** moved the cursor.

Jump

This function is used to go directly to a certain program line (see 5.2.1 Jump to line).

Clear line

- This button clears the entire program line and its text, depending on the current cursor position (see 5.2.4 Clear line).
- If you have entered text with the typewriter, the  key only deletes the text line, not the program line.
- In combination with the  key you can:
  - delete the entire program level (see 5.1.6 Deleting program contents).
  - delete the entire program management for upper, lower and bending beam (see 9.1 Fundamentals).
  - delete the tool configuration for upper, lower and bending beam in the program information (see 6.4 Entering program information).

Clear

This button can be used to clear a value you have entered on the 10-key pad. It clears the entire cursor field, and also affects auxiliary functions. If you have entered text, you can clear individual characters.

IMPORTANT: To enter data you need not clear the existing value, as the electronic system has an Auto Clear function (see 5.1.4 Auto Clear).

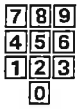
Enter

Use this button in the following situations:

- When copying values using the  key (see 5.2.5 Copy value).
- As an "=" key when using the calculator (see 5.5 Calculator).
- To confirm inputs, if the button is lit.

In all other cases, values are saved automatically.

10-key pad



These keys are where you enter numeric values. The decimal character must be a dot ("."). You can also use the 10-key pad in combination with the typewriter. The CNC controller continuously checks all entered decimal numbers for bounds. If you enter a value that is out of bounds, the controller tells you with this message:

Minus

This button is used to enter:

- negative values such as angle and backstop corrections.
- a minus sign on the calculator to negate a positive number.
- a hyphen in typewriter mode.

Note: With numeric values, you generally always have to enter the value first, then the sign. However, for calculating with the calculator you should use the soft key icon  (see 5.5.1 Basic arithmetic).

Point

Use this button for entering decimal numbers.

Help

This button displays context-sensitive help for the mode you are in (in preparation).

Service

This button displays the service level, providing information about:

- axes
- inputs and outputs

(see 12. Service level).

IMPORTANT: This level is interactive and can be accessed directly from any situation.

Service next

Switches you to the next service level.

Break

This function key is not assigned.

Step

Step mode for the bending beam. The beam only moves while the "Automatic start" foot switch is depressed (see 8.10 Bending beam step mode).

Start

in 

level, this button lets you run the program line containing the cursor. It does not matter where the cursor is in the line. While the program line is executing, the 

button is lit.

Auto start

This button runs several contiguous program lines (→ bending program). The cursor must be in the first line of the bending program.

If you start the program by pressing the 

key, the controller executes one program line after another until it encounters an empty line (= end of program). It then jumps back to the starting line and runs the bending program again (see 8.6 Running a multiple-line program).

Stop

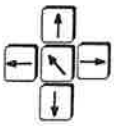
If this button is lit, the controller is in input mode. You can now write and edit programs, or change to a different mode.
If you press one of these functions:

-  Control off,
-  Emergency stop,

the controller will automatically switch to 

and processing halts immediately.

Editor



The keys shown on the left are required for controlling the cursor (see 5.1.2 Moving the cursor).

Home

Within the input window, you can move the cursor to the top left corner by pressing this button (see 5.1.2 Moving the cursor).

If you are entering text using the typewriter 

, use the button to select the individual letters and characters (see 5.3.1 Functions).

Page up

This button moves the cursor up one screen of text within the input window. Us it to "browse" quickly through the text lines (see 5.1.2 Moving the cursor).

Page down

This button moves the cursor down one screen of text within the input window. Us it to "browse" quickly through the text lines (see 5.1.2 Moving the cursor).

3.3. Soft keys

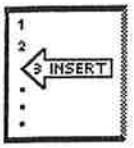
Soft keys are keys to which the controller assigns various functions (see 1.1 Introduction to the controller).

3.3.1. General soft keys

Text (typewriter)

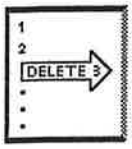
This is used to enter alphanumeric text, e.g. program names or information text (see 5.3 Typewriter).

Insert line



Insert one or more empty lines into a program (see 5.2.2 Insert line).

Delete line



This soft key function deletes one or more program lines (see 5.2.3 Delete line).

Mark block

To move or copy one or more program lines, you must first mark the lines as a block (see 5.2.6 Mark block).

Copy block

Use this soft key function to copy marked program lines to the current cursor position. The line numbers are automatically updated (see 5.2.7 Copy block).

Move block

This function moves a previously marked block of lines to the current cursor position. The line numbers are automatically updated (see 5.2.8 Move block).

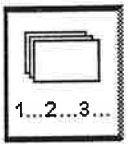
Plus

Increments the value by a specified amount, e.g. when changing a tool length (see 6.8) or when moving the bending beam in the Calibration menu (see 4.2).

Minus

Decrements the value by a specified amount.

Next screen



Continue to the next input screen.

For example: In the tool manager, move from upper beam tool set 1 to upper beam tool set 2.

Previous page

Go back to the previous input screen.

For example: In the tool manager, move from upper beam tool set 4 to upper beam tool set 3.

Exit

This soft key is used to exit the current level.

3.3.2. Main menu soft keys

In the main menu, the following icons appear at the bottom of the screen. You can choose them by pressing the associated function key F1 - F10.

Program input and execution level

In this level you can:

- enter and run complete bending programs (see 6.1.1 and 8.6 of the manual).
- enter and run individual program lines (see 6.1.1 and 8.5 of the manual).
- create and run variable programs (see 10. Variable programs).
- Check and modify parameter data (see 6.9 Parameter data).
- Create program information for the bending programs (see 6.4 Entering program information).

Technical specifications

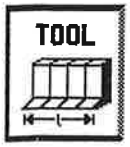
This menu provides information about the technical specifications of your folding machine (see also 4.3 Technical specifications).

Program management

In this level you can:

- Look at the directory (contents) of a diskette (see 11.1.2 Reading the diskette directory).
- Save and load programs to and from diskette (see 11.1.3 Saving and loading programs)
- Search for a program (see 11.1.5 How to find programs).
- read program information (see 11.1.4 Reading program information).
- Format diskettes (see 11.1.6 Formatting (deleting) a diskette).

Tool management



This level is used for defining and managing the upper, lower and bending beam tool sets. You can save the data to diskette, or load it from diskette (see 9. Tool management).

Calibration

This procedure involves referencing the individual axes (see 4.2 Calibration).

IMPORTANT: Work will not be possible with the machine if you do not calibrate!

3.3.3. Program input soft keys

Info: Auxiliary function = HF

From the main menu, press the PROG EDIT key to go to program input.

Program information level

Prog Info

Input level for program information (see 6.4 Entering program information).

For explanations of the TOOL TOOL TOOL soft keys, see TOOL level.

CAD level

This level is still in preparation so the soft keys has no function yet.

Parameter data

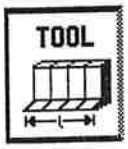
Para Data

PARA DATA

This soft key invokes the input level for parameter data (see 6.9 Parameter data).

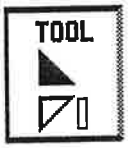
Tool positions

Tool Position



Choose this level to define the tool configuration (see 6.8 Tool positions (tool setup)).

UB Tool

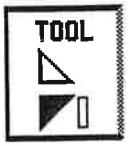


Choose the upper beam tool table to define the tool configuration for the bending program (see 6.8.2 Upper beam tool position).

BB Tool

Choose the bending beam tool table to define the tool configuration for the bending program (see 6.8.3 Bending beam tool position).

LB Tool



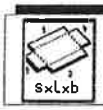
Choose the lower beam tool table to define the tool configuration for the bending program (see 6.8.4 Lower beam tool position).

Alight Right

Right reference point for configuring the bending tools (see 6.8.1 Fundamentals).

Alight Left

Left reference point for configuring the bending tools (see 6.8.1 Fundamentals).



Level for calculating developed dimensions

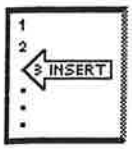
This level is in preparation, so the soft key has no function yet.

Text modules

Text Modules

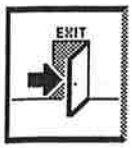
This soft key invokes the text modules (see also 5.4 Text modules).

Insert Text



Specify which of the 15 text lines to permanently store the copied text in (see 5.4.2 Entering and editing text modules).

Exit



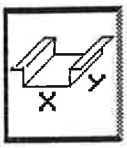
Exit the level without accepting the copied text (see 5.4.1 Fundamentals).

Exit With Text

Exit the level, accepting the copied text (see 5.4.3 Copying text to program lines).q

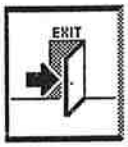
Soft keys with the cursor in this position: 

Variable Assignment



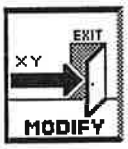
This soft key chooses variable assignment (see 10.5 Variable assignment).

Exit



This soft keys exits Variable Program mode. Values entered in the variable assignment table are not applied when you exit (see 10.1 Fundamentals).

Variable Prog.



This soft key function automatically applies all entered backstop values to the base program (see 10.7 Automatic program conversion).

Additional soft keys with the cursor in this position: 

Add the variable "U" to the backstop position of the current program line (see 10.3 Base program input with variable declaration). The current program line is marked by the input field on a white background (= cursor position). This function is in preparation!

Add the variable "V" to the backstop position of the current program line (see 10.3 Base program input with variable declaration). This function is in preparation!

Add the variable "W" to the backstop position of the current program line (see 10.3 Base program input with variable declaration).

Add the variable "X" to the backstop position of the current program line (see 10.3 Base program input with variable declaration). The current program line is marked by the input field on a white background (= cursor position). This function is in preparation!

Add the variable "Y" to the backstop position of the current program line (see 10.3 Base program input with variable declaration).

Add the variable "Z" to the backstop position of the current program line (see 10.3 Base program input with variable declaration).

Piece counter

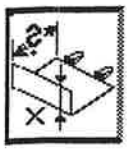
Activates the n"PCS" input field. Further details on entering the piece count are provided in 6.7 Piece counter.

Further cursor-dependent program input soft keys:

Angle Corr.

This soft key function takes you to the input window for angle corrections (see 7.1 Angle corrections).

Dim. Inc.



The dimension increment soft key converts the entered side lengths to the backstop position (see 6.2.1 Converting side lengths to the backstop position).

Backstop Corr.

This soft key function invokes the Backstop Correction level. The function makes it easy to correct side length errors. Please read section 7.3 Program-related backstop corrections.

With the cursor in position  **and the** 

key, the following soft keys are available:

Delta

Change to the Backstop Difference input field. In this window you can correct dimension errors caused by tool wear.

Cursor position  **and**  **:**

Math

Calculate the lower or bending beam adjustment using the material values:

- Plate thickness
- Strength
- Inside radius and
- Length of the part being folded

(see 6.2.3 Radius-related calculation of the bending and lower beam adjustment).

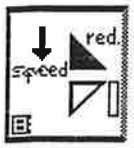
S x Factor

Calculate the lower or bending beam adjustment using an equation stored in the controller (see 6.2.2 Calculating the bending and lower beam adjustment).

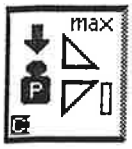
3.3.4. Auxiliary function soft keys

In the level PROG EDIT **and with the cursor in position**  **you will see the following soft keys:**

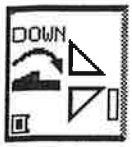
Reduced bending beam speed, indicated by the letter "A" in the cursor field (see 6.6.2 Reduced bending beam speed). For speed adjustment, see 6.9.2 Bending beam parameters.



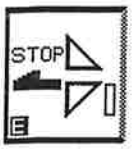
Reduced closing speed of the upper beam, indicated by the letter "B" in the cursor field (see 6.6.3 Reduced upper beam speed).
For speed adjustment, see 6.9.1 Upper beam parameters.



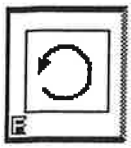
Increased pressure of the upper beam, indicated by the letter "C" in the cursor field (see 6.6.4 Increased upper beam pressure).



Lower the backstop flaps during position, indicated by the letter "D" in the cursor field (see 6.6.5 Lower backstop flaps).

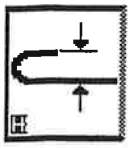


Backstop halt in a program line to prevent continuing with the next program line, indicated by the letter "E" in the cursor field (see 6.6.6 Stop backstop).



Operator instruction to turn the plate, indicated by the letter "F" in the cursor field (see 6.6.7 Turn and reverse plate).

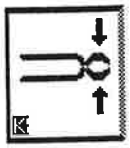
Operator instruction to reverse the plate, indicated by the letter "G" in the cursor field (see 6.6.7 Turn and reverse plate).



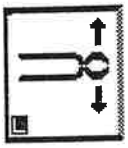
Produce hollow beads. The upper beam closes (guided parallel) to a predefined value. This function is indicated by the letter "H" in the cursor field (see 6.6.8 Produce hollow beads).

Mark bending with the upper beam while the bending beam is swung (max. 25 degrees), indicated by the letter "J" in the cursor field (see 6.6.9 Mark bending).

The following auxiliary functions are available from the background level (Next):



Clamp the plate with the chuck (optional), indicated by the letter "K" in the cursor field (see 6.6.10 Locking and releasing the clamps).



Release the chuck (optional), indicated by the letter "L" in the cursor field (see 6.6.10 Locking and releasing the clamps).

3.3.5. Program management soft keys

From the main menu, choose the  soft key function to enter the program manager.

Directory

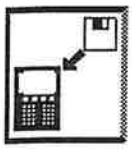
Reads the diskette directory (see 11.1.2 Reading the diskette directory).

IMPORTANT: You must do this after changing the diskette in the diskette manager!

Find

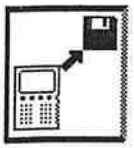
Searches for the program you need (see 11.1.5 How to find programs).

From diskette



This soft key loads a program into main memory with its parameters, program information and tool configuration (see 11.1.3 Saving and loading programs).

To diskette



Saves your program to the diskette, with its parameters, program information and tool configuration (see 11.1.3 Saving and loading programs).

Prog. Info

This function provides information about:

- the program number and name
- the date and status of the program
- plate dimensions, strength and material
- general information on the program marked by the cursor.

This function does not load the program into memory (see 11.1.4 Reading program information).

Delete Disk

This function deletes the contents of a diskette and at the same time formats it (see 11.1.6 Formatting (deleting) a disk).

3.3.6. Tool management soft keys

From the main menu, choose the 

soft key function to enter the tool manager.

UB Tools

Select the tool tables to define the individual upper beam tool sets (max. 15 sets) (see also 9.2 Definition of upper beam tool sets).

BB tools

Select the tool tables to define the individual bending beam tool sets (max. 10 sets) (see also 9.3 Definition of bending beam tool sets).

LB tools

Select the tool tables to define the individual lower beam tool sets (max. 5 sets) (see also 9.4 Definition of lower beam tool sets).

Note: Use the 

and 

to move through the tool sets.

3.3.7. Calibration soft keys

From the main menu, choose the  soft key function to enter the calibration menu.

Once you have checked the actual values of the bending beam and lower beam (see 4.2), choose this icon again to start the calibration procedure.

This soft key function takes you to a special service level of the controller where you can move axes that have not been calibrated (see 4.1 Notes on commissioning and service work).

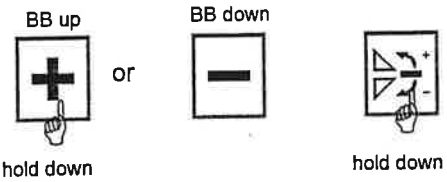
ATTENTION: This level is for specially trained and instructed service personnel only! The bending beam angle axis need only be moved for repair and service work.
Follow the safety instructions under 4.1 of this manual.

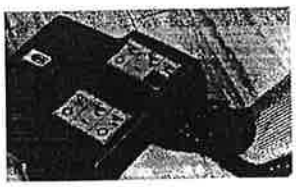
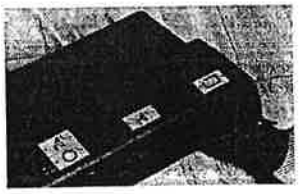
Exit the level by choosing the  soft key.

Bending Beam Up/Down

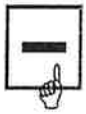
The bending beam up/down function is only available in combination with the F1 or F2 key. The right foot switch "bending beam start" must also be pressed.

Bending beam up



Then use the foot switch   to start the bending beam.

Bending beam down



press

hold down

The bending beam swings down until it reaches its zero point.

Notes:

4. Switching on

4.1. Notes on commissioning and service work

Follow the machine operating manual to conduct the incoming inspection and set up the machine.

First-time commissioning

After setting up and securing the machine, plug in the connecting cables from the operating panel to the electronics.
Before connecting the electrical feeders, make sure the operating voltage indicated on the nameplate of the switch cabinet matches your local mains supply. After connecting to the power outlet, first check the direction of rotation of the main motor (hydraulic drive).

Proceed as follows:

- Switch on at the main switch on the back of the switch cabinet.
- Check that the CNC controller is ready.

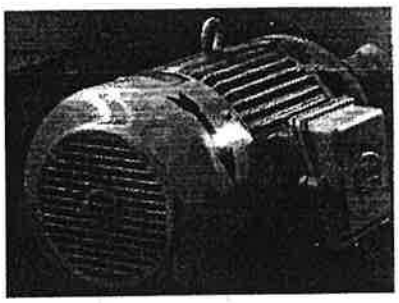
  ☛ It is ready when:

  The STOP key on the operating panel is lit and all other lamps are out. At the same ime the two soft keys SERVICE must appear on the monitor with instruction text.

- Check the direction of rotation by turning the key-operated switch and then **immediately** switching it off again with the button.

ATTENTION: Switch the motor on only briefly, as the pump will be damaged if the direction of rotation is wrong.

The direction of rotation must match the direction indicated by the arrow on the motor (clockwise when looking at the ventilator cowl).



If the direction of rotation is wrong, swap two of the feeder leads, e.g. L1 and L3 (first make sure the main switch is set to "O").
q If you have an instrument for measuring the direction of rotation, the phase sequence in the feeder must be clockwise. The motors are factory-fitted with the appropriate terminals.

If the direction of rotation is correct, those of all other installed motors will also be correct.

Commissioning

When the machine is connected, switch on as follows:

- Turn on at the main switch on the back of the switch cabinet.
- Check whether the CNC controller is ready.

  It is ready when: The STOP key on the operating panel is lit and all other lamps are out.

  At the same time the two soft keys   must appear on the monitor with instruction text.

  When switching the machine on after service work, please read the section entitled "Service work". If not, the machine must be calibrated as described in section 4.2. After calibration you are automatically at the main menu from which you can choose the mode of operation.

Service work

After the following work you must select the 

level before calibrating the machine:

- After service work on the bending beam.
- After working on the electrical system or electronics.
- After service work on the measuring and counting system of the individual axes.

The displayed window shows the actual values of the individual axes. To check the counting direction of an axis, you must move it manually (e.g. by turning the spindle of the main backstop).

When you do this, the numeric values should **increase** in the following directions:

upper beam right	→	when opening
upper beam left	→	when opening
bending beam	→	when swinging up
backstop	→	back

Change the service level of the controller using the 

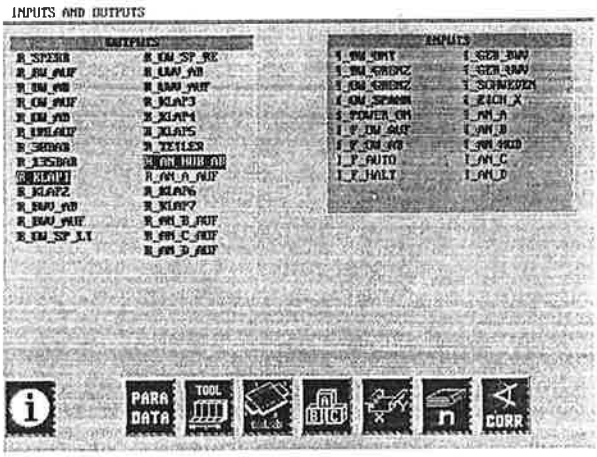
and 

keys.

This level shows the

- setpoint and actual positions of all axes, and
- the statuses of all outputs and inputs.

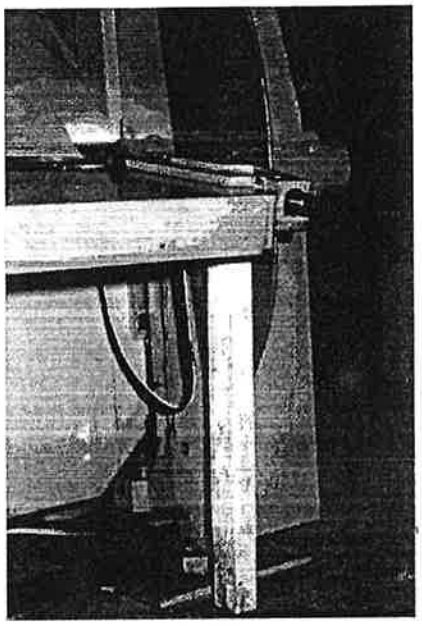
(See also 12. Service level.)



When doing service work on the bending beam (e.g. on the drive and measuring system of the bending beam adjustment unit), you must swing the beam out into its 90° position. **Please read the following safety notes carefully:**

ATTENTION - Safety instructions

Before doing any service or repair work below the swung-out bending beam, place supports under it, turn off at the main switch and lock the main switch in place with a padlock. The person responsible for the work should keep the key with him.



In order to insert and remove the supports, you must be able to move the bending beam in the SERVICE level without it being calibrated.

To do this, use the + − soft key functions.

The bending beam is moved up by pressing the + keys and simultaneously pressing the "bending beam" foot switch.

hold depressed

The bending beam is moved down by pressing the − keys.

hold depressed

Never, **under any circumstances**, calibrate a supported bending beam using the key!

4.2. Calibration

When the bending beam has a support under it, such as after service work, do not start the calibration program (the calibration program lowers the bending beam).

See section 4.2 Service work.

IMPORTANT: After replacing the upper beam tools with tools of a different height (from 3.937 inch to 7.874 inch (100 mm to 200 mm)), you must recalibrate the machine.

Every time you switch on at the main switch you must calibrate the displacement systems for

- upper beam
- bending beam and
- backstop.

This procedure references the axes.

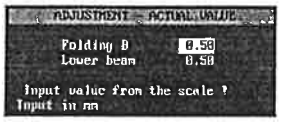
The displacement measuring systems of the

- bending beam adjustment and
- lower beam adjustment

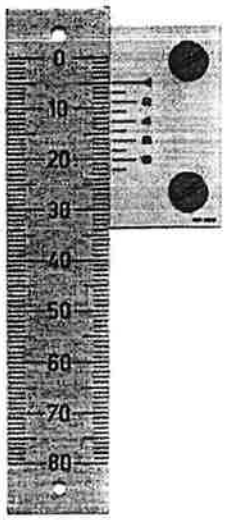
have no reference point; rather, they store their actual values to a battery backed RAM.

Proceed as follows:

- After switching on at the main switch, the following window appears on the screen:



- You will see the last actual values for the bending beam and lower beam. Make sure the displayed actual values match the scale values of the two axes.

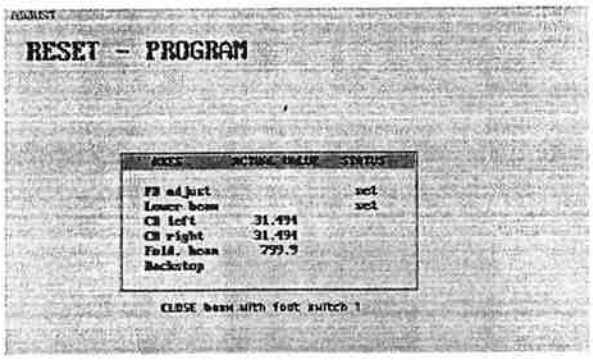


Correct the displayed values if necessary.

- Switch machine power on with the key-operated switch.

- Press the  soft key.

The following window appears, with the prompt:



- Make sure there are no objects lying on the upper beam.
  Close the upper beam with the foot switch.

Note:
- As soon as an axis has been calibrated, the Status column shows the word "calibrated".
- Once all 6 axes have been calibrated, the main menu appears on the screen.

Calibration procedure:

- The upper beam closes until pressure switch (S4) responds.
  The displacement measuring system of the upper beam is zeroed.
  The upper beam remains closed.

- The bending beam then swings down until the "bending beam down" limit switch (S1) is reached.
  The axis is calibrated using the zero pulse of the rotary transducer.

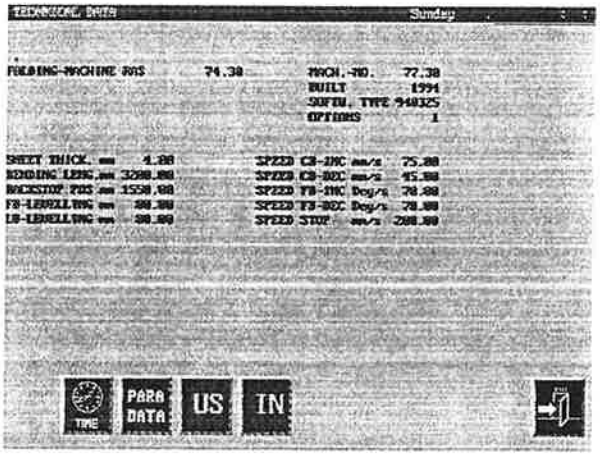
- The upper beam opens to a predefined gap.

- The backstop moves to its maximum dimension, switches the inductive switch (S10) and picks up its reference dimension via the zero pulse of the rotary transducer.
  The backstop then runs slowly towards the upper beam until the inductive switch is free again.

Notes:

4.3. Technical specifications

This level provides information on the technical specifications of your folding machine.
The level is for information only; no inputs or changes are possible!
The displayed values are used by the Save parameters level.



Some important specifications:

Machine no.	Quote this machine number in all enquiries and spare parts orders to us.
Built	The year of construction, helps to identify your folding machine quickly.
Prog. rev.	This line contains the revision date of the software installed in your machine.
Options	The digits give us a summary of what options you have installed in your machine.
Plate thickn.	Important information for all operators. The value indicates the maximum plate thickness for your tool system.

The other details indicate the maximum travel distances and the maximum speed of your machine.

Explanation of soft keys:

This soft keys switches between various language versions. Existing language options are:

- Germany
- Great Britain
- America

This function lets you toggle between millimetres and inches as the units of measure.

This function displays the Parameter data window.
Explanations of the individual windows are provided in section 6.9 Parameter data.

Exit the level by pressing the  soft key.

5. Input

5.1. Help with inputs

5.1.1. Input sequence

- A complete bending program consists of:
  - the program (see 6. Program input)
  - program information (see 6.4)
  - parameter data (see 6.9)

ATTENTION: Check the parameter data before you switch the machine on or run the program.

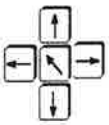
- When you enter the individual program lines you do not need to stick to a certain input order. You can start by entering all of the bending angles, then the backstop dimensions etc., or you can enter the program one line at a time.
- You only need to enter program information if you intend to save the program to diskette (see 11.1.3).
- Use the auxiliary editor functions when entering the program (see 5.2). This will help you work quickly and effectively.
- Arithmetic functions are also available and will help you reduce input errors (see 6.2).

5.1.2. Moving the cursor

You can only enter data on the screen at the insertion point marked by the cursor.

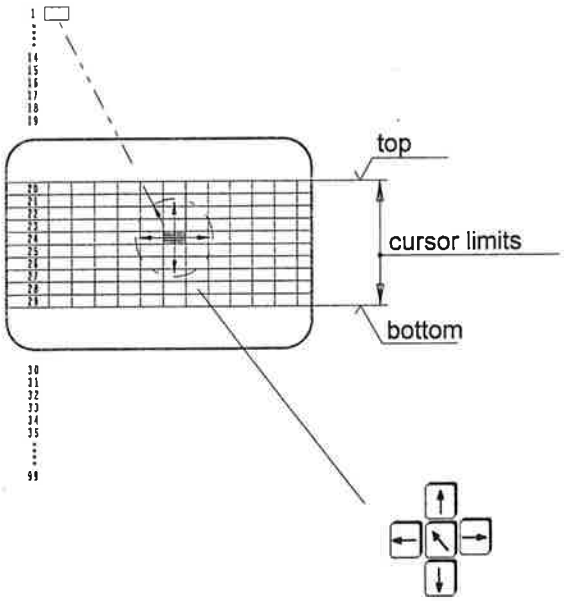
(The cursor is the reverse-video block which automatically changes size.)

So that you can enter and edit text in any order, the electronic system has built-in cursor control using arrow keys with which you can move the cursor left, right, up or down.



In the middle of the cursor keys is a Home key with which you can jump straight to the first character of the first program line. In the Typewriter function, use the Home key to shift characters (see 5.3 Typewriter).

The screen can only display a limited number of lines at a time. The cursor control lets you scroll to lines that are not currently visible, which happens automatically as soon as the cursor hits the top or bottom edge.



In typewriter mode you can move the cursor anywhere in the displayed text using the ← → keys (see 5.3.1 Functions).

5.1.3. Checking inputs

The controller will display messages to tell you about inputs that are out of bounds

as soon as you press a cursor key or try to run the program with the START or AUTO key.

The cursor can only be moved if you have entered a legal value.

You can either overwrite the illegal value, or delete it with the CL key.

Note: The message displayed by the controller indicates the maximum and minimum values for that input field.

5.1.4. Auto Clear

An entered value is automatically stored without having to be confirmed with the ENT key.

If you move the cursor onto a field containing a value, you can enter the new value immediately without having to first delete the existing value.

Pressing a key on the 10-key pad automatically clears the old value.

This function is only active if preceded by a cursor movement.

5.1.5. Restoring deleted values

If you accidentally overwrite a value, you can restore the old value (which is kept in the Undo memory) by pressing the [UNDO] key.

Note: This is only possible if you have **not** moved the cursor since you entered the new value.

The Undo memory is cleared by pressing the [CL] and [CL LINE] keys.

5.1.6. Deleting program contents

The CNC controller has a battery backed RAM memory containing the data from

- program input (see 6. Program input)
- tool positions (see 6.8)
- tool management (see 9. Tool management).

You can delete the individual levels as follows:

PROG EDIT

Pressing the CL and CL LINE keys simultaneously deletes the entire program. The parameter data and program information is retained.

TOOL

In the Tool positions level of program input, press the CL and CL LINE keys to delete the entire contents of the upper, bending and lower beam tools. This also deletes the tool positions in the program information (see 6.4).

TOOL

The tool management data (soft key in the main menu) can be deleted by pressing the CL and CL LINE keys simultaneously.

5.2. Auxiliary editor functions

The following auxiliary editor functions can be used in PROG EDIT level.

5.2.1. Jump to line

JP

Example:

You want to move the cursor to program line 35 from its current location in line 3.

Proceed as follows:

If you were to move to line 35 by pressing the Down arrow key ↓, it would take you a long time.

The JP function will get you to the new program line much faster.

Press the JP key function.

Next to the Info window you will see a small yellow window.

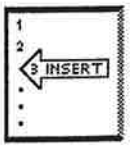
On the 10-key pad 7 8 9 / 4 5 6 / 1 2 3 / 0, enter the line number to jump to, in this case 35.

The entered line number appears in the window.

Press the JP key again and you will find yourself at line number 35.

Note: If you enter a line number that is too high (e.g. 60), the cursor will stop at the last available line.

5.2.2. Insert line



Example:

You want to insert one or more empty lines between lines 5 and 6.

Proceed as follows:

Use the cursor keys   or the  function to go to line number 6.

You can also get there by scrolling with the  and  keys.

Added lines are always inserted before the current cursor position.

Choose the  key to display the background function keys.

Press the  function key to insert an empty line between lines 5 and 6.

You can repeat this procedure as often as you want to insert empty lines.

The procedure is visually verified by gaps appearing between the lines on the screen; the gaps only appear below the cursor.

Note: If the last program lines already have values entered in them, you cannot insert lines with the Insert function.

5.2.3. Delete line

Example:

You want to delete line number 3.

Proceed as follows:

Use the ↑ ↓ cursor keys or the JP function to move to line number 3.

Press the NEXT key to display the background function keys.

Press the  soft key to remove the line. Each further keypress removes a further line.

ATTENTION: Only use the  soft key function if you are sure the line of data is no longer needed. If you are too hasty here you could lose data.

5.2.4. Clear line

Example:

You want to delete the contents of a line but leave the line itself intact.

Proceed as follows:

Use the  cursor keys or the  function to move to the line you want to clear. It does not matter where the cursor is on the line.

Press the  key and the contents of the line are removed, leaving the line empty.

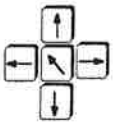
5.2.5. Copy value

Example:

Values often repeat themselves when you are entering a program. Bending angles of 90°, for example.

With the least possible effort, you want to copy an entered value to subsequent lines.

Proceed as follows:

Use the cursor keys  to move the cursor to the input you want to copy.

Press the  key and hold it down. Now press the  or  key to copy the marked value.

Note: The copy function only works within the column containing the cursor. You can copy values either upwards or downwards.

5.2.6. Mark block

Example:

To move or copy program lines you must first mark (select) a block of lines.

You want to mark a block consisting of lines 2 to 8.

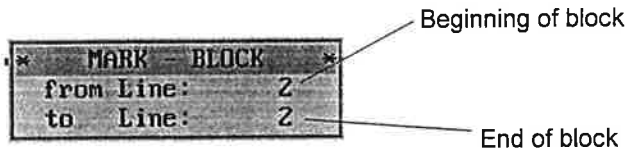
Proceed as follows:

Use the cursor keys  to move to the beginning of the block, in our example to line number 2. It does not matter which column the cursor is in.

Press the  key to take you to the next soft key level.

This is indicated by the pink colour of the soft keys.

Press the  soft key to activate the Mark block function. You will now see the following window:



The block contains only line 2. As you want to include more lines in the block (in this case up to line 8), move the cursor down with the  cursor key. Each keypress increases the size of the block by one line until line number 8 appears in the window.

Once you have defined your block, choose the  soft key function again to save the block. All input levels have their own buffer memory.

5.2.7. Copy block

Example:

You should not have to repeat lines you have already entered once. Copying them saves a lot of time.

Proceed as follows:

The block to be copied must be in the buffer memory as described in 5.2.6 Copy block.

Change to the next soft key level by pressing the  key.

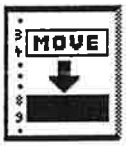
Move the cursor to the line before which you want to copy the marked block.

Choose the  soft key function to copy the block. All subsequent lines are shifted down

and automatically renumbered. You can repeat the copy procedure anywhere in the program; it always uses the marked block that is in memory. This block remains in memory until replaced by a new one.
If you do not have enough memory, the copy procedure will do nothing.

You can delete lines you don't need with the  soft key function, see 5.2.3.

5.2.8. Move block



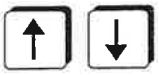
Example:

You want to move (relocate) a program block or an individual program line.

Proceed as follows:

The block you want to move must first be marked (see 5.2.6 Mark block).

Press the  key, unless you are already in the next soft key level (pink soft keys).

Use the  cursor keys to move to the line before which you want to move the marked block.

Choose the  soft key function to move the block.

5.2.9. Delete individual value

Example:

You made a mistake when entering a value, and you want to correct it.

Proceed as follows:

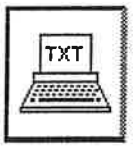
If you are still in the field containing the wrong input, simply clear it by pressing the CL key.

If you have already moved the cursor, you do **not** have to press the CL key to overwrite the incorrect value.
The Multibend controller has an auto clear function (see 5.1.4 Auto clear).

Note: Restoring deleted values with the UNDO is only possible in combination with auto clear.

Notes:

5.3. Typewriter



The typewriter of the Multibend controller can be invoked from three levels:

- Program input (text modules see 5.4)
- Program information (see 6.4)
- Variable assignment (see 10.5)
- Tool management (see 9. Tool management)
- Diskette management (see 11.1.5 How to find programs)

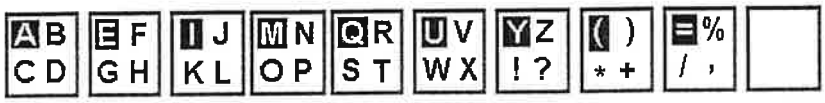
The typewriter has the following character set:

- upper case letter from A to Z
- extended characters . - ( ) ! ? * + , / = %
- digits from 1 to 9

You can only invoke the typewrite when the cursor is in a position that required alphanumeric input.

5.3.1. Functions

Choose the  function. The following soft keys will appear at the bottom of the screen:



Press a function key F1 - F10 to copy the reverse-video letter from the corresponding soft key to the input field.

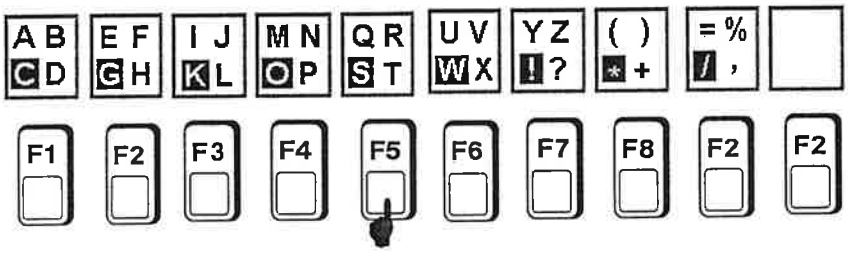
Select the letter with the  key.
light

Exit typewriter mode by pressing the  key.

Example:

You want to type the letter "S". Select the letter with the  key.

All letters in the bottom left corner of the soft keys are now highlighted.

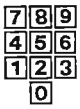


Press key F5 to copy the letter "S" to the input field.

Each time you press the  key, the reverse-video mark progresses through the alphabet. When you type, concentrate only on the soft keys. Change the highlighted letters with your left hand, and select the letters with your right hand. With a bit of practice, you will soon get quick at this!

Use the  key to delete individual characters, and the  key to delete an entire cursor block.

If you need a hyphen, use the  key; for numbers from 0 to 9, use the 10-key pad



You can make corrections by simply overwriting existing letters.

Exit typewriter mode with the  or  key.

Notes:

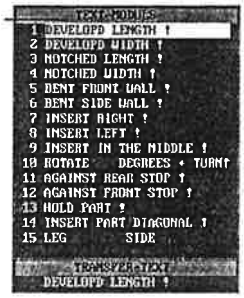
5.4. Text modules

5.4.1. Fundamentals

Text modules are predefined pieces of information text.
When you write a bending program, you can enter these text modules in the program line as information. They will provide you with important information about handling the plate while the program is running (a bit like a work plan).
You can define 15 different permanent text modules to add to program lines.
You can replace individual text modules at any time.

In Program input level, invoke Text modules with the  soft key function.

Text line with text module

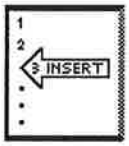


Cursor position

The info text of the cursor position and copy text are identical when the level is entered.

Use the  cursor keys to select one of the text lines in the window. The text module is automatically displayed in the "Copy text" line.

Explanation of soft keys:



This soft key function inserts an info text from the Copy text line to the list of text modules (see 5.4.2 Entering and editing text modules).

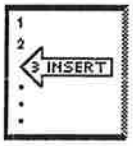
Choose the typewriter to create or edit the text. Then exit typewrite mode with the

key (see 5.3.1 Functions).

Exit the level without copying the text module.

Exit the level after copying the text module to the current program line (see 5.4.3 Copying text to program lines.

5.4.2. Entering and editing text modules



You can enter or modify text modules to suit your own needs at any time.

Proceed as follows:

- To edit a text module, use the cursor keys to move the cursor to the text line. The info text automatically appears in the Copy text line.
  If you are creating a new text module, the position of the cursor field does not matter.

- 

Go into typewriter mode. You can now either edit the text, or create a completely new one (see 5.3.1).

  Use the 

key to delete an individual character, or the 

key to delete the entire info text.

- Exit typewriter mode by pressing the  key.

- 

This soft key function copes the new info text to the list of permanently stored text modules. The following small yellow window will appear:

  Enter the line number in which you want to store the info text.

  Note: If you specify a number that is already in use, the text module will be overwritten!

- Confirm the input by pressing the  soft key once more.

5.4.3. Copying text to program lines

You want to copy a text module into the current program line of your bending program.

There are two different kinds of text module:

1) permanently stored text modules 1 to 15

2) specially created info texts.

Proceed as follows:

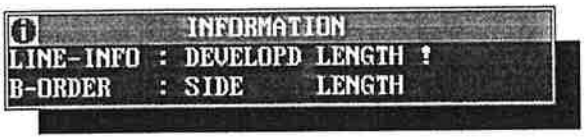
- Use the cursor keys to move the cursor to the text line (1 - 15) containing the desired text module.

or

- Choose the  soft key to enter typewriter mode (see 5.3.1) and enter the special info text.
  The info text is displayed in the "Copy text" line.

  Note: The controller only copies the text that is in the Copy text line!

-  Use this soft key function to copy the info text to the current program line.



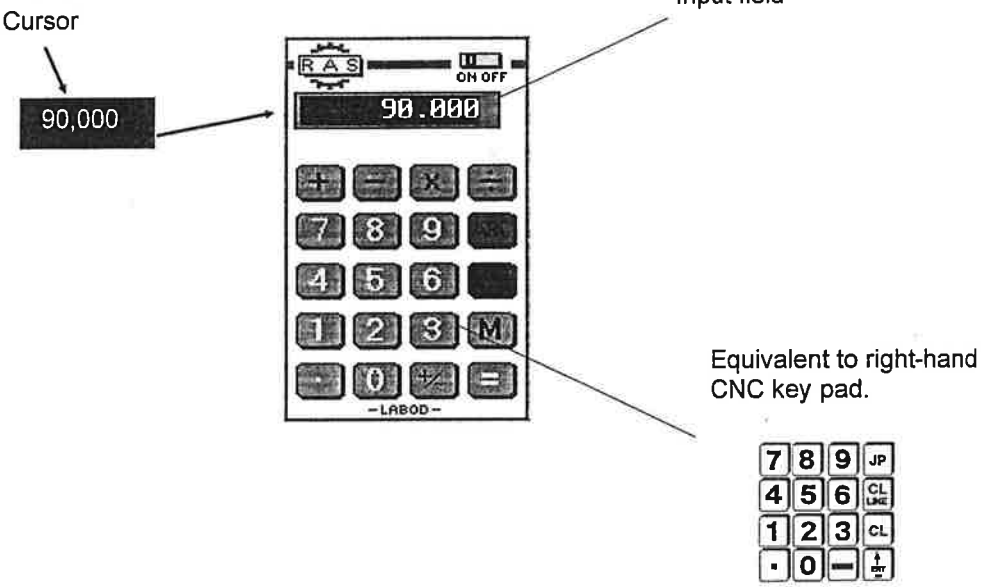
5.5. Calculator

The calculator provides a wide range of functions with which you can do calculations easily and very accurately (15 decimal digits).

The following functions are available:
+, -, *, :,√, x^2,
sin, cos, tan, arcsin, arccos, arctan.

Invoke the calculator by pressing the  key. The key then flashes.
You can use the calculator anywhere in the program.

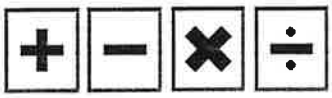
The calculator is then displayed on the screen.



The input field automatically contains the value of the current cursor field so that you can calculate with it.
The number of decimal digits is limited externally to 3, but the calculator uses 15 decimal digits internally.

Use the  key to enter a decimal point.

The basic arithmetic functions are available from the soft key bar.



The  key on the CNC keyboard does not have an arithmetic function, but changes positive numbers to negative and vice versa. If you want to enter "-3", **first** press the 3 and **then** the "-" sign.

To save a value to memory, use 

To retrieve the value from memory, press 

(see 5.5.4).

You can also use these keys to copy values to the current cursor field (see 5.5.5).

The 

key produces a further set of functions (see 5.5.2 and 5.5.3).

The 

key provides inverse functions. For example, you can determine an angle from a tan value (arcus) or calculate a power instead of a root (see 5.5.2 and 5.5.3).

The 

key lets you delete the most recent input.

The 

key deletes all values and the memory.

Exit the calculator by pressing the flashing  function key.

5.5.1. Basic arithmetic (+ - x :)

After invoking the calculator , the value from the last cursor position automatically appears in the input field.

In our example, we do not want to use this value in our calculation. Press the CL LINE key to clear the value from the calculator display. This will also clear anything that is in the calculator memory.

Addition (+)

Example:

To add **two positive** numbers:

48.5 + 345.5 = 394.0

Proceed as follows:

4 8 • 5 + 3 4 5 • 5 ENT =

F2

Example:

To add **two negative** numbers:

(-22.6) + (-12.0) = -34.6

Proceed as follows:

2 2 • 6 − + 1 2 − ENT =

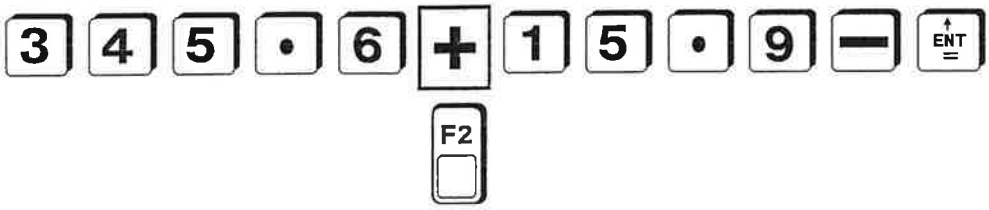
F2

Example:

To add a **positive** and a **negative** number:

345.6 + (-15.9) = 329.7

Proceed as follows:



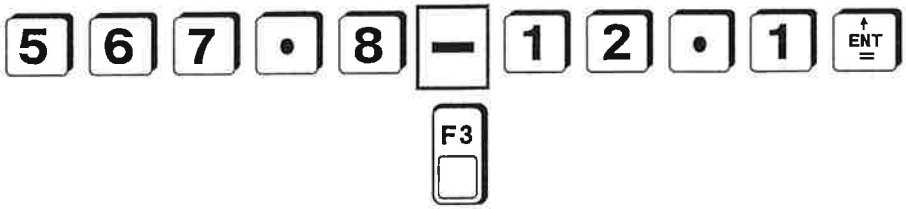
Subtraction (-)

Example:

To subtract **two positive** numbers:

567.8 - 12.1 = 555.7

Proceed as follows:

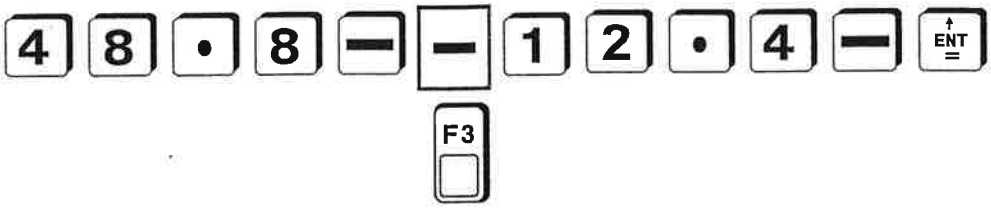


Example:

To subtract **two negative** numbers:

(-48.8) - (-12.4) = 36.4

Proceed as follows:



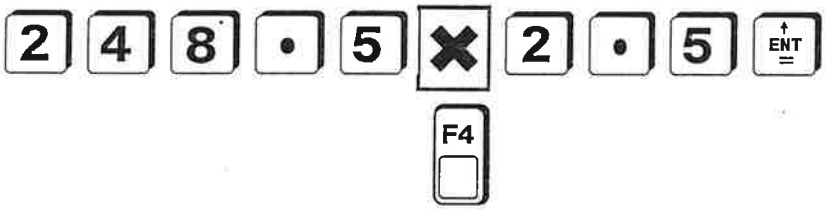
Multiplication (x)

Example:

To multiply **two positive** numbers:

248.5 x 2.5 = 621.25

Proceed as follows:

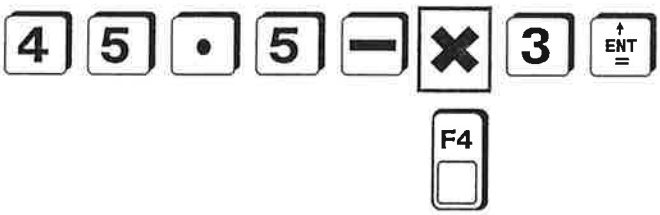


Example:

To multiply a **negative** and a **positive** number:

(-45.5) x 3.0 = -136.5

Proceed as follows:



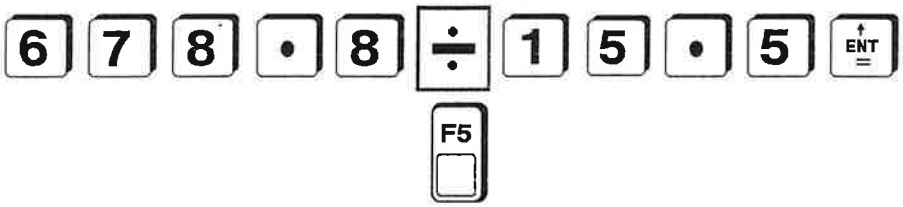
Division (:)

Example:

To divide with **two positive** numbers:

678.8 : 15.5 = 43.794

Proceed as follows:

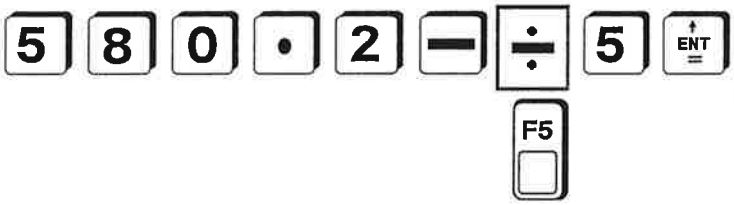


Example:

To divide with **negative** numbers

(-580.2) : 5.0 = -116.04

Proceed as follows:



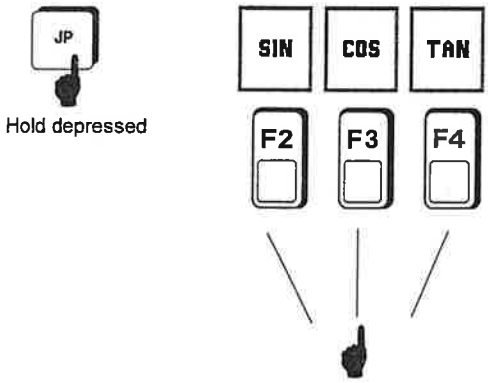
5.5.2. Trig functions (sin, cos, tan, arcsin, arccos, arctan)

Note: If you are not familiar with trigonometry, you can brush up your knowledge with section 5.5.6 Basic geometry.

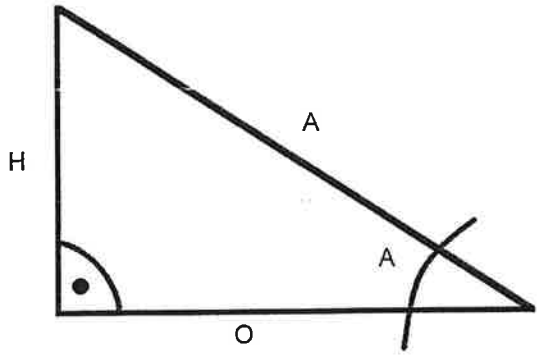
The trig functions are provided in the NEXT level of the calculator.

The SIN COS TAN soft keys produce the sine, cosine or tangent of an angle.

If you press and hold the JP key, you can apply the arg function to determine an angle from the sine, cosine or tangent.



All trigonometrical calculations refer to a right-angled triangle.



H = hypotenuse

A = adjacent side

O = opposite side

The sine, cosine or tangent value is a ratio of 2 side lengths, where

- $\sin\alpha = \frac{O}{H}$
- $\sin\alpha = \frac{A}{H}$
- $\sin\alpha = \frac{O}{A}$

Sine (sin)

To determine the sine value of an angle, first enter the angle in the calculator. Switch to the trig function level with the NEXT key and then choose the SIN function key.

Exercise: What is the sine of 30?

Proceed as follows:

3 0 NEXT SIN = 0.5

F5

Arc sine (arcsin)

SIN
arc

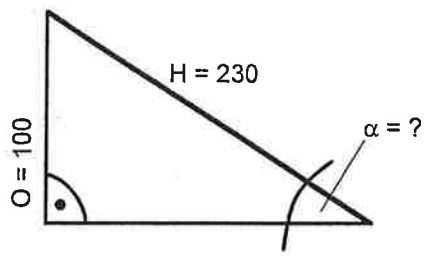
To determine the angle in a triangle, first determine the sine from the hypotenuse and opposite side.

This value is converted to the angle using the key combination JP and SIN

hold depressed!

F2

Exercise: What is the angle in the following triangle?



Proceed as follows:

1 0 0 ÷ 2 3 0 ENT = (0.434....)

F5

NEXT → JP SIN = 25.77°

F2

Cosine (cos)

COS

Exercise: What is the cosine of 15?

Proceed as follows:

1 5 NEXT COS = 0.956....

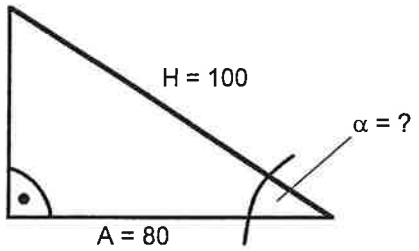
F3

Arc cosine (arccos)

COS

arc

Exercise: What is the angle in the following triangle?



Proceed as follows:

8 0 ÷ 1 0 0 ENT = 0.8

F5

NEXT → JP COS = 36.87°

F3

Tangent (tan)

TAN

Exercise: What is the tangent of 30?

Proceed as follows:

3 0 NEXT TAN = 0.577....

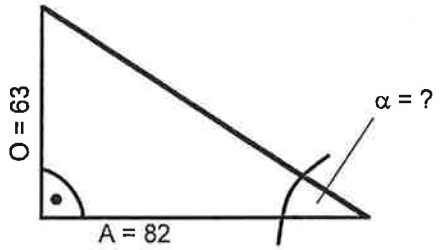
F4

Arc tangent (arctan)

TAN

arc

Exercise: What is the angle in the following triangle?



Proceed as follows:

6 3 ÷ 8 2 ENT = 0.768....

F5

NEXT → JP TAN = 37.53°

F4

5.5.3. Square root (√) and powers (x)

Note: Section 5.5.6 (Basic geometry) explains the $\sqrt{x}$ x^2 functions using the theorem of Pythagoras.

The function keys for NEXT are included in the $\sqrt{x}$ x^2 level of the calculator.

Square root (√)

$\sqrt{x}$ calculates the square root of a given number.

Exercise: What is the square root of 64?

Proceed as follows:

6 4 NEXT $\sqrt{x}$ = 8

F5

Power (x^2)

After entering the root number, it can be multiplied by itself in the calculator.

The calculator does not have a separate function for raising to a power.

The 

key has an inverting function here too, as with the trig functions. For example, the

function in combination with 

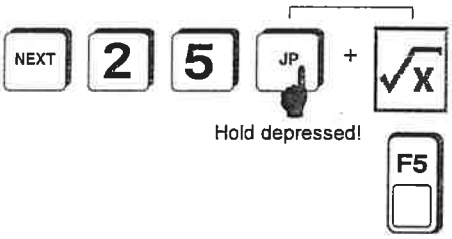
Hold depressed!
and 

becomes the 

function.

Exercise: What is 25?

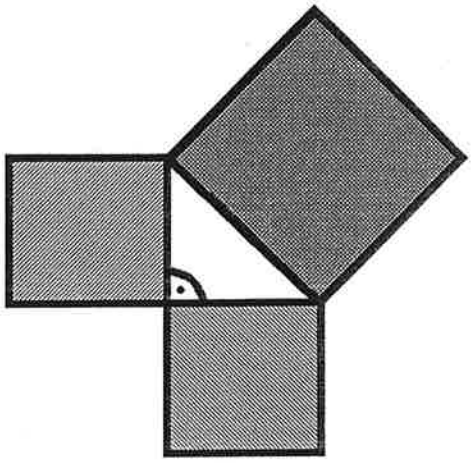
Proceed as follows:



Example:

We want to use the theorem of Pythagoras to calculate the side length of a triangle.

Exercise:



a = 50

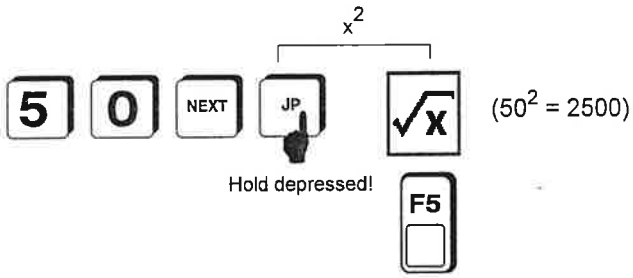
b = 70

c = ?

$$c = \sqrt{c^2 + b^2} = \sqrt{50^2 + 70^2}$$

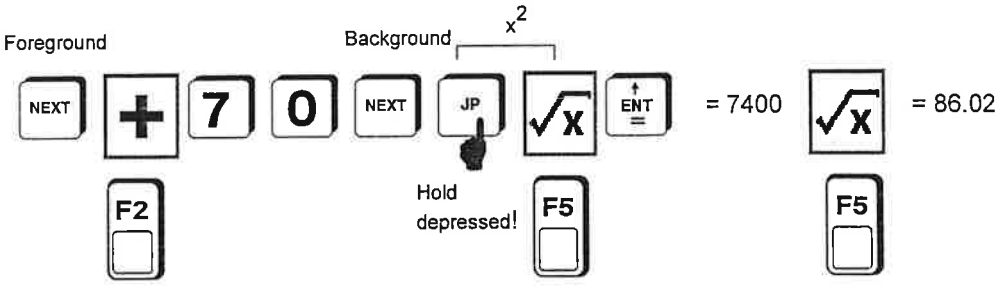
Proceed as follows:

1.)



($50^2 = 2500$)

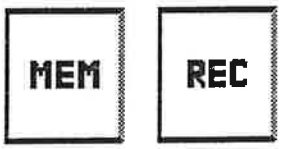
2.)



= 7400

= 86.02

5.5.4. Memory functions



If you want to store an intermediate result for further use, you can save it to memory.

The MEM function key saves the result to memory.

The REC key retrieves the value from memory.

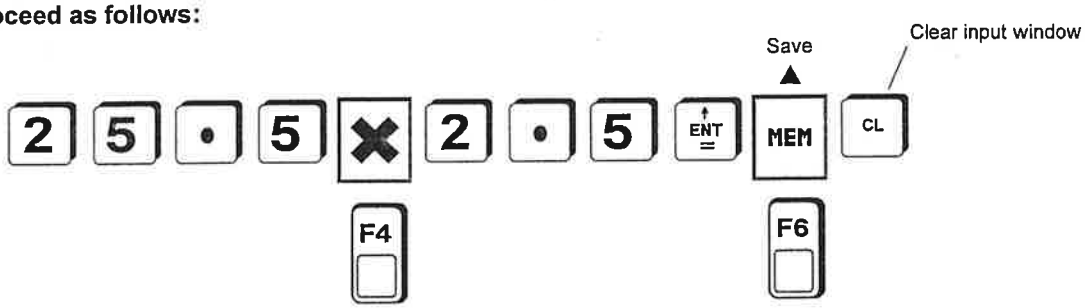
Exercise:

$$\overbrace{(25.5 \times 2.5)}^{(1)} + \overbrace{(400.20/5.0)}^{(2)} = 142.54$$

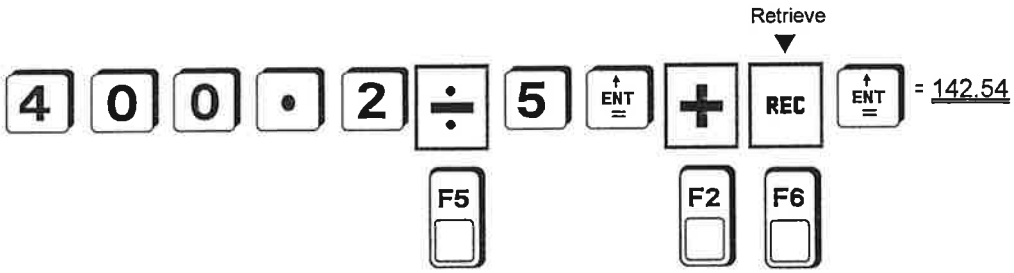
We want to save the result of the multiplication (1) so that we can add it to the sum of the division (2).

Proceed as follows:

1.)



2.)



5.5.5. Copying values

MEM

You can copy the results of calculations directly from the calculator into the program line containing the cursor.

There are two ways of doing this:

1.) Copy calculation results into the program.

2.) Copy values from the program into the calculator and then copy the result of the calculation back into the program.

As soon as you invoke the calculator, the value of the cursor field appears in the input.

You can clear this value with the CL key, or use it in your calculations.

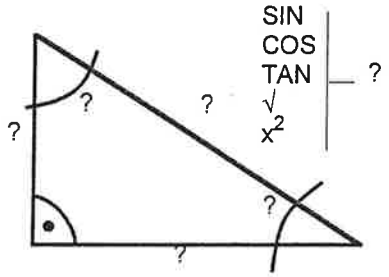
To copy the result back to the cursor position, press the MEM function key before you exit the calculator.

For safety reasons, the Multibend controller will only accept viable results. This means that if a viable value is exceeded, you can see the result of your calculation in the program line but you will not be able to move the cursor out of the field. If you try to do so, the message

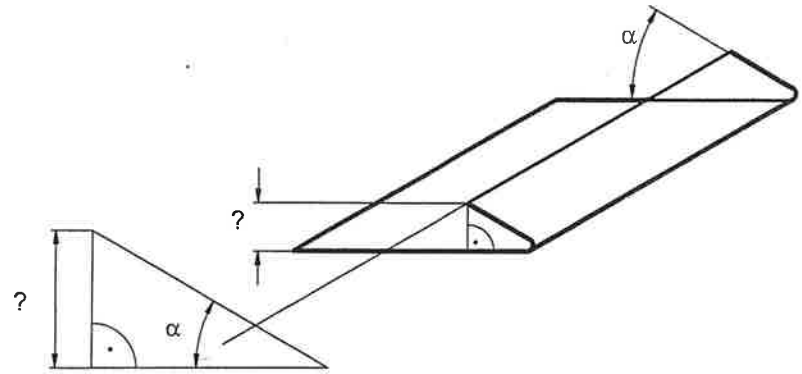
Value too large

will appear. The value will not be enabled until you change or delete the value.

5.5.6. Basic geometry

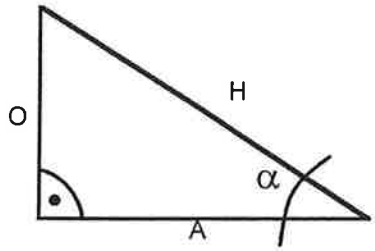


IMPORTANT: All calculations using the trigonometrical functions assume a right-angled triangle.
This means one of the three angles of the triangle **must** be 90°. So, for example, we might have to split the triangle up into right-angled triangles. When doing this it is often useful to use additional lines to assist.



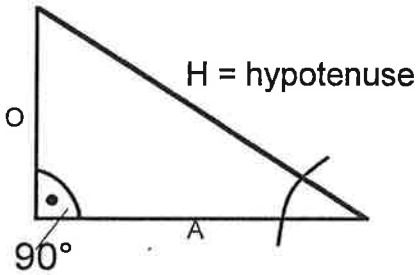
In a right-angled triangle, the sides and angles have fixed relationships!

Angle α:



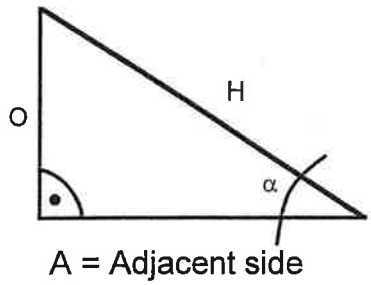
Angle is either the angle that is to be calculated, or it is used in the calculation. It is always one of the two angles that is not 90°. Angle can be greater than or less than 90°.

Hypotenuse:



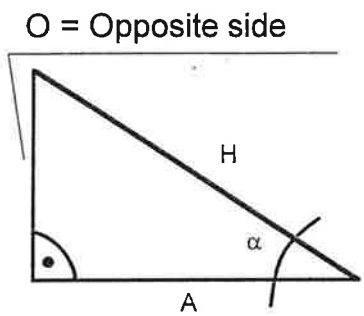
The side opposite the 90° angle is called the hypotenuse, and is always the longest side. It is denoted by "H".

Adjacent side:



The adjacent side is the side that together with the hypotenuse forms the angle . It is the side that is *adjacent* to the angle, and is denoted by "A".

Opposite side:



As its name suggests, this side is the side *opposite* the angle , and is denoted by "O".

Which variables must be known?

Knowing the ratio between two sides, you can use the trig functions to determine the angle.

Knowing one angle and one side length, you can calculate the second side length or the hypotenuse.

This means:

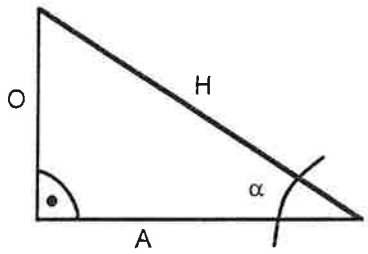
- Side length calculations → require one side and one angle.
- Angle calculations → require two sides.

You can also calculate side lengths without knowing any angles, but this requires that you apply the theorem of Pythagoras rather than the trig functions (see Using the theorem of Pythagoras).

What are the sine, cosine and tangent?

The sine, cosine and tangent (or sin, cos and tan) are numbers which represent ratios formed by dividing one side length by another, where

- $\sin = \frac{O}{H}$
- $\cos = \frac{A}{H}$
- $\tan = \frac{O}{A}$



So this division produces a dimensionless number rather than an angle.

The sine and cosine are always less than 1 (e.g. 0.028).

The tangent can be greater than 1, in which case the angle is greater than 90°.

How do we get an angle from the sine, cosine and tangent?

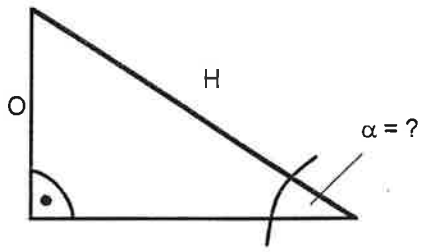
The inversion of a sine, cosine or tangent to form an angle is called the "argument" or arg function.
The angles are available in tables in various handbooks on the subject.
But your calculator can calculate the value faster and more accurately.
The arg function is performed using the "JP" key.

For example, if a sine value has been produced by dividing G by H, the angle is produced by:

Hold depressed

Do not press the  function key until you have pressed and are holding the  key.

Exercise with sine:



Known: hypotenuse (H) = 178.15
opposite side (O) = 85.0

wanted: angle (α) = ?

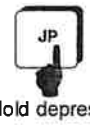
1.Form the sine value:

$$\sin = \frac{O}{H}$$

SIN is the ratio between the opposite side and the hypotenuse.

$$\sin = \frac{85}{178.15} = 0.477...$$

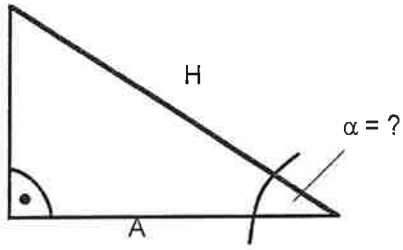
2. Determine the angle



Hold depressed

To convert the sine to the angle (α), use the arg function. The result is an angle of 28.498°.

Exercise with cosine:



Known: H = 385.0
A = 135.5

Wanted: α = ?

1. Form the cosine

$$\cos = \frac{A}{H}$$

COS is the ratio between adjacent side and hypotenuse.

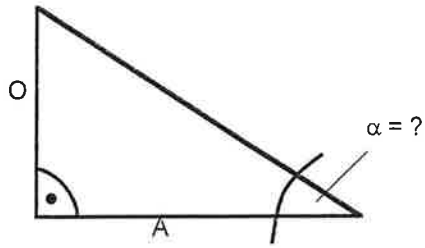
$$\cos = \frac{135.5}{385} = 0.352...$$

2. Determine the angle

Hold depressed

When we convert with the arg function, the result is 69.393°

Exercise with tangent:



Known: O = 423.5
A = 244.5

Wanted: α = ?

1. Form the tangent

$$\tan = \frac{O}{A}$$

TAN is the ratio between opposite side and adjacent side.

$$\tan = \frac{423.5}{244.5} = 1.732...$$

2. Determine the angle

Hold depressed

When we convert with the arg function, the result is 60.001°.

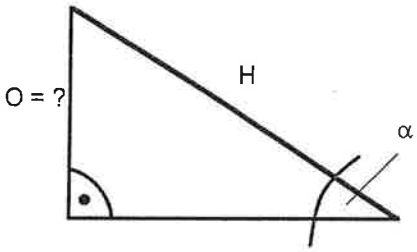
How do we get the length of a side from an angle and a side?

As we know, the sine, cosine and tangent are ratios between two sides. Each angle has its own ratio, and these are very easy to find with the calculator.

All you have to do is enter the angle in the computer and press SIN COS TAN to produce the sine, cosine or tangent.
You can find the length of the second side by multiplying the calculated ratio by the length of the known side.

Exercise with sine:

SIN



Known: H = 135
α = 15°

Wanted: O = ?

1. Form the sine from the angle
   - Enter the angle 15°.
   - Use the SIN function key to find the sine.
   - The result is 0.258...

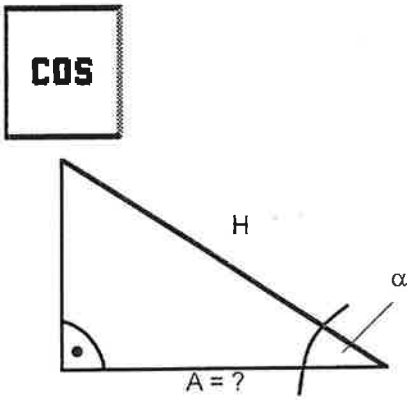
2. Calculate the length

The ratio calculated above is less than 1. As we know, the legs are always shorter than the hypotenuse.

$$O = \sin\alpha \times H$$

By multiplying sin x H = 0.258 x 135 = 34.941 , we have the opposite side, which is shorter than the hypotenuse.

Exercise with cosine:



Known: H = 85
α = 22°

Wanted: A = ?

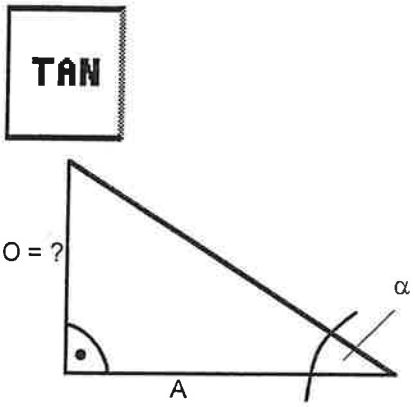
1. Form the cosine from the angle
   - Enter the angle 22°
   - Convert with COS
   - The result is 0.927...

2. Calculate the length

$$A = \cos\alpha \times H$$

A = 0.927 x 85 = 78.811

Exercise with tangent:



Known: A = 245.5
α = 30°

Wanted: O = ?

1. Form the tangent from the angle
   - Enter the angle 30°
   - Convert with TAN
   - The result is 0.577...

2. Calculate the length

$$O = \tan\alpha \times A$$

O = 0.577 x 245.5 = 141.739

Calculating side lengths using the theorem of Pythagoras

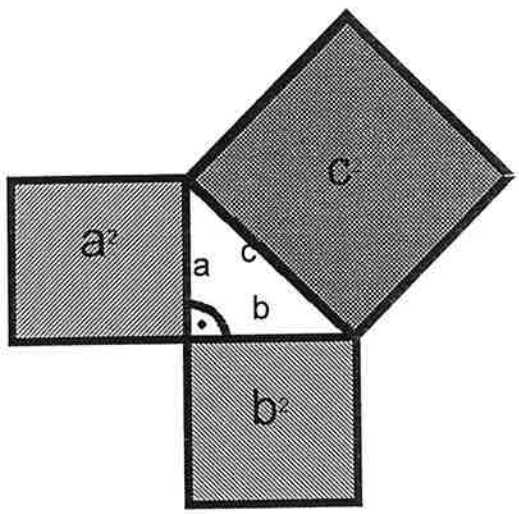
You will often know the lengths of two sides and need the length of the third side.
In this case you could use the two known sides to determine the angle, and then continue by using the angle and one of the two known sides to determine the length of the third side.

However, this calculation is much more quickly done using the theorem of Pythagoras (a Greek philosopher).

The theorem of Pythagoras says:

> The square on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides.

This means:

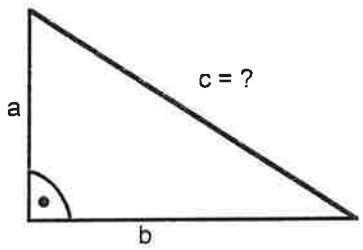


$$c^2 = a^2 + b^2$$

We can rearrange the equation to calculate any of the sides of the triangle.

- $c = \sqrt{a^2 + b^2}$
- $a = \sqrt{c^2 - b^2}$
- $b = \sqrt{c^2 - a^2}$

Calculating c (the hypotenuse):



Known: a = 100
b = 200

Wanted: c = ?

$$c = \sqrt{a^2 + b^2} = \sqrt{100^2 + 200^2} = 223.60$$

1. Find the squares of the sides

   $a^2 = 100^2 = 10000$

   $b^2 = 200^2 = 40000$

2. Add the two squares together

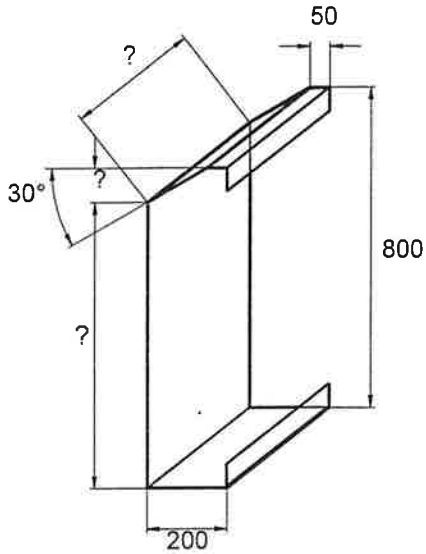
   $a^2 + b^2 = 10000 + 40000 = 50000$

3. Find the square root of the sum

   $\sqrt{a^2 + b^2} = \sqrt{50000} = 223.60$

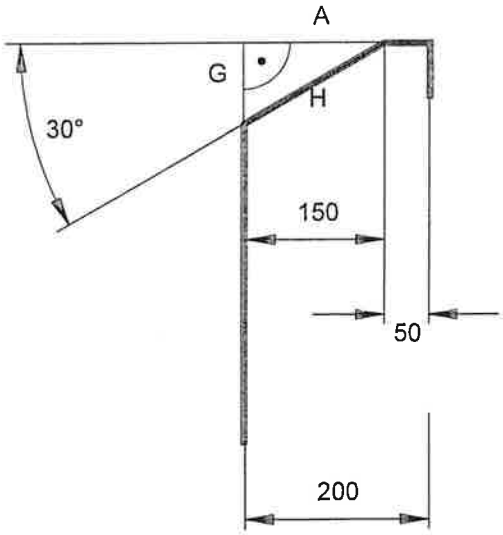
Example (summary):

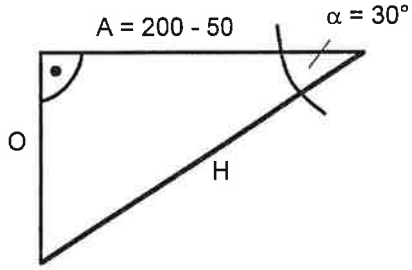
We want to calculate the missing values in a cover which has the following shape.



We know 3 dimensions and 1 angle
We want to find 3 further dimensions.

1. Find a triangle and define the sides





2,Calculate the hypotenuse

$$\frac{A}{H} = \cos\alpha \rightarrow \text{converted to} \quad H = \frac{A}{\cos\alpha}$$

$$H = \frac{150}{\cos 30°} = \frac{150}{0.866} = 173.2$$

3. Calculate the opposite side using the theorem of Pythagoras

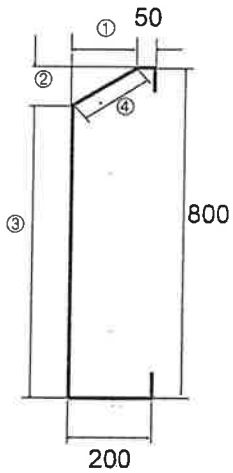
$$a = \sqrt{c^2 - b^2}$$

$$O = \sqrt{H^2 - A^2}$$

$$O = \sqrt{173.2^2 - 150^2} = 86.59$$

a = O (opposite side)
b = A (adjacent side)
c = H (hypotenuse

4. Combine the results with the known dimensions



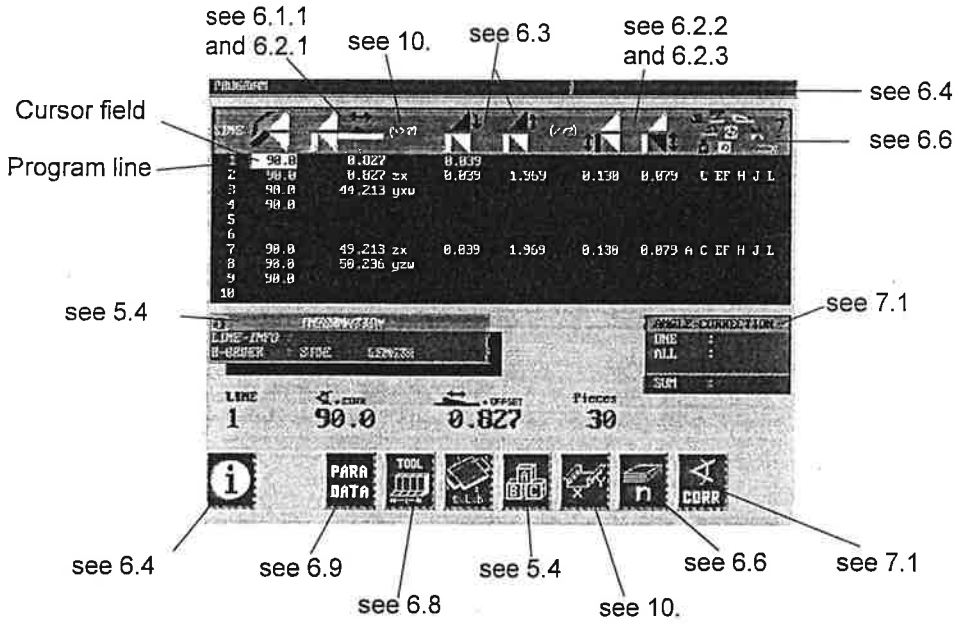
Notes:

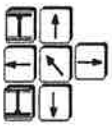
6. Program input

6.1. Fundamentals

The program input and execution level consists of 7 columns and 40 lines. All functions required for entering and running programs are provided in this level.

The  soft key takes you from the main menu to the program input and execution level.



When you enter the  level, the cursor field is always in the first column of the first program line (). You can use the cursor keys  to move the cursor.

Values can only be entered in the columns containing the cursor.

At the top of the screen is a bar on a green background, containing:

- the current program mode of the controller
- the name and number of the loaded bending program.

There are three distinct program modes:

1) program input (see 6. Program input)
2) variable program (see 10. Variable programs)
3) program execution (see 8. Running programs)

You can only enter bending programs or individual program lines if the STOP key is lit (program input).

Above the soft keys is the following line:

Current program line

Entered bending angle + angle correction

Backstop position + backstop correction

Current piece count (see 6.7)

Depending on your inputs, the controller will display further information on this line (see 6.5.1 Line-related information).

Examples:

PROGRAM END

INACTIV

INFO LINE

A bending program consists of at least 1 program line.
Multiple-line programs must not contain empty lines, as these are interpreted as the end of the program.
You can also include several subroutines in a bending program (max. 40 lines) (see 6.1.1 Program sections (subroutines).

For parts with the same bending sequence but different dimensions, such as

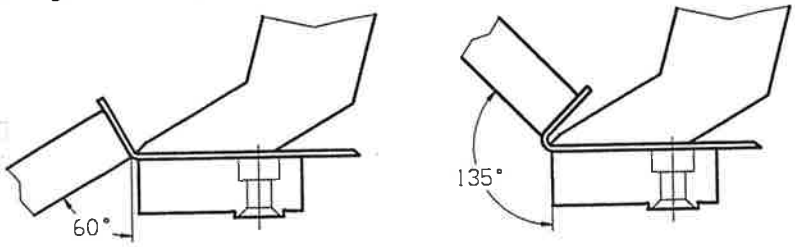
- doors
- case-bays
- shelves
- window cornices etc.,

it is a good idea to program the parts as subroutines (see 10. Variable programs).

Explanation of the input columns:

Bending angle

Enter the bending angle (e.g. 90°). Enter angle corrections separately, see 6.9.2 Bending beam parameters and 7.1 Angle corrections.



ATTENTION: max. bending angle = 180° minus angle of upper beam tool.

Backstop position

Enter the backstop position. You need not take the block dimensions of the backstop rows into account; the controller automatically selects the backstop row that is nearest the backstop.

Minimum backstop position: depends on the lower beam tool (about 0.394 inch (10 mm)).
Maximum backstop position: 59.055 inch (1500 mm) (optional 80.709, 100.394, 120.079, 159.449 inch (2050; 2550; 3050; 4050 mm)).

If you do not enter a backstop position, the backstop will run with lowered backstop flaps to its maximum position and you will have a free work surface. This will make it easier to turn large plates and work from markings.

Variable assignment (w, x, y, z) to the backstop position is invoked with the  soft key function. The assignment only takes effect in combination with variable programs (see 10. Variable programs).

Variable programs are used to bend parts with the same bending sequence but different dimensions.

Close upper beam

Enter the closing height of the upper beam. Only enter this value if you:

- are not clamping a plate in the centre.
- have to press hollow beads to a certain dimension.
- are clamping materials with a sensitive surface (tool impressions).

(Read section 6.3 Notes on upper beam input.)

Open upper beam

Enter the opening height of the upper beam after bending.

- If you do not enter a value, the controller uses the value specified in PARA DATA as the opening dimension (see 6.9.1 Upper beam parameters).
- Opening heights less than the parameter value are not set. In this case the upper beam parameter value is used automatically.

Maximum opening height of the upper beam: 15.748 inch (400 mm).

Bending beam stroke

Enter the bending beam stroke adjustment referred to the bending beam pivot point.

- If no value is entered, the most recently set value is used.
  Always enter a value if you are creating individual program lines. For complete programs, the value need only be entered once, in the first line.
- The inputs depend on the plate thickness and inside radius.
  Find the right values using the mathematic calculation aids.
  - S x factor (see 6.2.2) WE HAVE TALLER THAN STANDARD BENDING BEAM TOOLING. IT IS 1.378" TALLER.
  - Math (see 6.2.3) 1.378 + MAT. THICK + 25% OF MAT. THICK

IMPORTANT: To prevent damage to the machine, the smallest dimension must not be less than 1.2 x the plate thickness. + 1.378

Lower beam stroke

Enter the lower beam stroke adjustment.

- If no value is entered, the most recently set value is used.
  Always enter a value if you are creating individual program lines. For complete programs, the value need only be entered once, in the first line.

- The inputs depend on the plate thickness and inside radius.
  Find the right values using the mathematic calculation aids.

  – S x factor (see 6.2.2)

  – Math (see 6.2.3)

IMPORTANT: Values entered for the bending beam stroke and lower beam stroke should be identical to achieve ideal bending results.
The one exception to this is when using special bending tools that are higher.

Auxiliary functions

Select auxiliary functions from the displayed soft keys. A further set of soft keys is available by pressing the key NEXT .

The selected auxiliary function is indicated in the program line by a letter. The selected soft key is shown in reverse video.
When the program runs, the selected soft keys are visible at the bottom of the screen (see also 6.6 Auxiliary functions).

6.1.1. Program sections (subroutines)

The controller memory holds 40 program lines that are available for program input.
When you save a program, all 40 lines are always saved whether or not there are values entered. Most bending programs will require only 10 - 20 program lines. Complete fabricated parts often consist of several individual components.

Example:

HOUSING
- CASONG SHEET
- LEFT SIDE SECTION
- RIGHT SIDE SECTION
- COVER

Backstop position (A) = total or remaining developed view minus the side

You can integrate several individual components into a bending program. In the Multibend 9000 controller, the bending program does not have to start at line 1.

In our housing example, you could use one program to fabricate

- the casing sheet (program lines 1 - 6),
- the side sections (program lines 7 - 24), and
- the cover (program lines 25 - 32)

in a single program run. The piece counter counts the number of complete housings after each program run.

Note: You can also bend individual parts of the housing at any time. To do this, insert an empty line (see 5.2.2) after each part. The controller interprets the empty lines as the end of the program for the individual part.

Also remember:

- Because of the larger number of program lines used, you can easily integrate line-related info lines. This gives the operator important instructions and information when the program is running, such as:
  - the name of the subroutine (casing sheet)
  - the developed length and width
  - turn or reverse the plate
  - assignment of legs and side sections.

6.2. Mathematic calculation aids

To assist with program input, the Multibend 9000 controller provides a number of calculation functions.
These functions save you having to perform complicated arithmetic calculations and simplifyinput to a great extent.

6.2.1. Converting side lengths to the backstop position (dimension increment)

This soft key function lets you convert side dimensions directly to the effective backstop position. This function will save you a lot of additional calculation work.

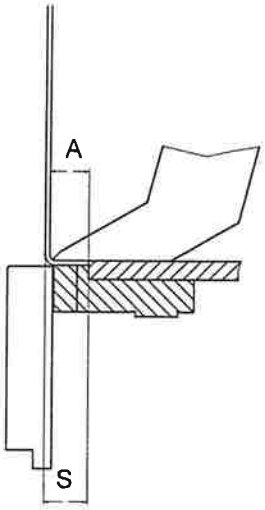
There are two different ways of positioning the plate:

1) direct positioning of the plate

2) indirect positioning of the plate

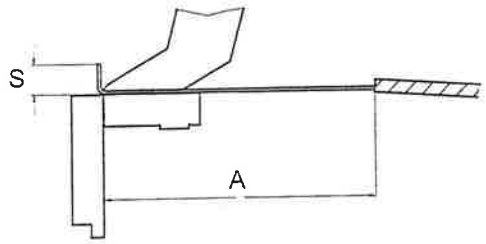
1) Direct positioning:

The side being bent is positioned directly on the backstop. The backstop position (A) is the same as the side length (S). Use this positioning method for small parts only, as otherwise you will always have the long side in front of the machine.



2) Indirect positioning:

The big advantage of a folding machine is that with large-surface parts, the long side always remains on the backstop table.
Only the short sides project over the bending edge and are bent.

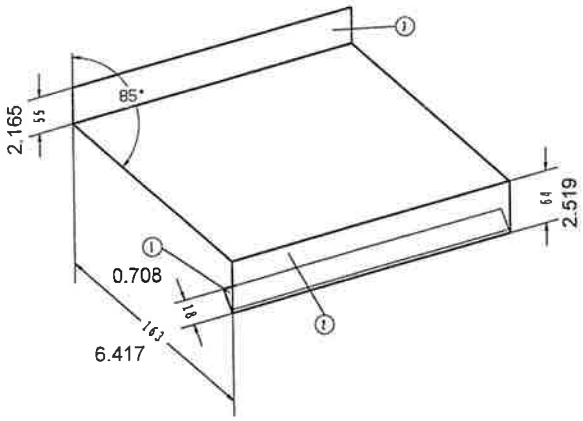


To determine the effective backstop dimensions of the individual sides, you would normally have to continuously subtract the side dimensions from the remaining developed length.

The  soft key function does this calculation for you.

Example:

We want to make a window cornice.
Plate width: 11.811 inch (300 mm)
Sheet thickness: 0.039 inch (1 mm)
All dimensions are inside dimensions. We determine the effective backstop positions.



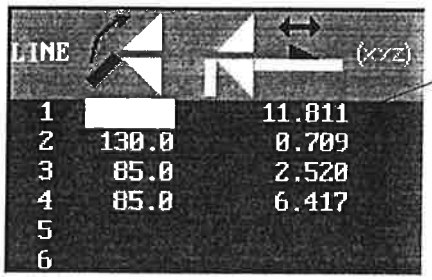
Proceed as follows:

Use the cursor keys to move the cursor field to the  column of a free program line.
Enter the plate width 11.811 inch (300 mm) as the backstop dimension.

Note: As soon as you enter a backstop position in a program line, the controller recognises the line as an info line; we need the input for further calculations.
Put the "Developed width" text module in the line (see 5.4.3 Copying text to program lines).
This line is ignored when the program runs.

Enter the side dimensions below this dimension heading in the subsequent lines, taking account of the desired bending sequence (see drawing).

When you enter the associated angle you should see the following:



INFO LINE
"DEVELOPED WIDTH"

Side dimensions

Converting the side dimensions to the effective backstop position:

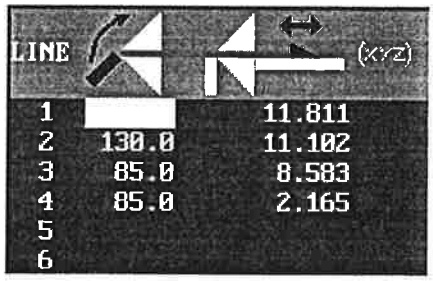
Move the cursor field to the first backstop position (0.709 inch (18 mm)) and choose the 

soft key function.

Subtract the entered side dimension from the developed width; the backstop position for the first side is 11.102 inch (282 mm).

Use the  cursor key to move to the next backstop position. Choose the dimension increment function once again.
Subtract the side dimension 2.520 inch (64 mm) from the last backstop position. The result is the second backstop position.
Repeat this function until all side lengths have been converted to effective backstop positions.

Our bending program has changed as follows:



effective backstop positions

6.2.2. Calculating the bending and lower beam adjustment (S x factor)

In this function the controller uses the entered sheet thickness and an internal formula to calculate the smallest possible bending and lower beam adjustment. The result is the minimum inside radius of 1.2 x s (s = sheet thickness).

IMPORTANT: Values entered for bending beam stroke and lower beam stroke should be identical to achieve ideal bending results.
The one exception to this is when using special bending tools that are higher.

Exercise:

You want to bend a plate with the smallest possible inside radius. What must you enter for the bending beam and lower beam adjustment?

Proceed as follows:

We are in the program input level.

Use the cursor keys to move the cursor to the Bending beam adjustment column  and specify the thickness of the plate.

To start the calculation, choose the 

soft key function. The calculated adjustment is entered automatically.

There are now two ways to find the lower beam adjustment:

- Repeat the above procedure in the Lower beam adjustment column 
- Use the value found in the bending beam adjustment column.

Note: If you always require the same bending radius in a bending program, you need only enter the adjustment values in the first line of the program. The values then apply to all subsequent lines.

With this calculation function you have determined the smallest possible bending radius. Forlarge radii, you must determine the bending and lower beam adjustments with the  function (see 6.2.3).

Adjustment when the bending beam is higher

ATTENTION: When entering the program in the Bending beam adjustment input column , take account of the bending beam tools (e.g. 1.378 inch (35 mm)). Using the sheet thickness and the FAKTOR soft key, calculate the bending beam adjustment and add to it the height increase of the bending beam tools.

Example of a program line:

0.039 (1.0)
(plate thickness) FAKTOR

+ height increase of bending beam tools

6.2.3. Radius-related calculation of the bending beam adjustment (math)

If you want to bend plates with a large inside radius (possible to a limited extent) or with a radius track, you must account for the

- sheet thickness
- material strength
- desired inside radius, and
- length of the part being bent

in the bending beam and lower beam adjustment.
If one of these values changes within a program, you must also change the adjustment values of the bending beam and lower beam.

To determine these radius-related adjustment values, the Multibend controller has a calculation function which also accounts for the deflection of the bending beam itself.

Exercise:

You want to bend a plate with the following values:

Thickness:	0.047 inch (1.2 mm)
Strength:	58 ksi (400 N/mm^2)
Inside radius:	0.394 inch (10 mm)
Length of the bend:	59.055 inch (1.5 m)

You do you find the optimal adjustment values for the bending beam and lower beam?

Proceed as follows:

We are in the program input level.

Use the cursor keys to move the cursor field to the  column (bending beam adjustment) or  column (lower beam adjustment).

Choose the  soft key function to open the following input window:

Use the 10-key pad  to enter the numeric values from the exercise defined above.

Delete false values with the  key.

Once all values have been entered correctly, exit the editing level with the  soft key.

When you exit the input window, the calculation automatically starts. The Multibend controller immediately calculates the adjustment value for the bending beam and lower beam; you see both values on the screen.

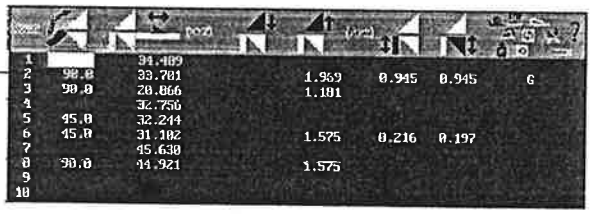
Note: If there are already values in the Bending and lower beam adjustment column of the program line when you choose the  soft key function, those values will be overwritten.

If the adjustment values for the bending and lower beam do not change in the program, you need only enter them in the first complete program line. They then remain in effect for all subsequent program lines until

- they are replaced by other values
- the end of the program (empty line) is encountered.

Example:

first complete program line



1		94.489				
2	90.0	33.701	1.969	0.945	0.945	G
3	90.0	20.866	1.181			
4		32.756				
5	45.0	32.244				
6	45.0	31.102	1.575	0.216	0.197	
7		45.630				
8	90.0	44.921	1.575			
9						
10						

Values remain in effect

Upper value is replaced and remains in effect until end of program

Notes:

6.3. Notes on upper beam input

We distinguish between the following clamping methods for the upper beam:

- Pressure-related clamping (see 6.3.1)
- Dimension-related clamping (see 6.3.2)
- Closing beads (see 6.3.3)

The upper beam has two separate displacement measuring systems, mounted on the left and right near the upper beam guide.
There are also pressure switches and pressure valves for measuring clamping pressure integrated into the hydraulics.

The possible clamping forces of the upper beam are:

Normal clamping force:	13488.54 lbf (60,000 N)	(39.48 atm (40 bar))
Increased clamping force:	47209.90 lbf (210,000 N)	(133.23 atm (135 bar))
Minimal clamping force:	0 - 13488.54 lbf (0 - 60,000 N)	(using displacement measuring system)

The upper beam has an additional mechanical parallel guide which prevents it from tilting during uncontrolled closing movements.
If one of the two displacement measuring systems fails, the upper beam halts automatically.

The clamping speed of the upper beam can be controlled continuously from 1-99% in the program (see 6.6.3 Reduced upper beam speed and 6.9.1 Upper beam parameters).
The increased clamping force of the upper beam is activated as an auxiliary function (see 6.6.4 Increased upper beam pressure).

Note: When clamping short plates (up to 19.685 inch (500 mm)) in the centre of the machine, always specify a target position for the upper beam (dimension-related clamping).

Do not use the 

function.

This will preserve the cambering of the lower beam.

6.3.1. Pressure-related clamping

In most applications you will be using pressure-related clamping, i.e. the upper beam moves down, without a specified target position, until a counter-pressure has built up when clamping the plate.
A pressure switch detects the clamping pressure of the upper beam. When the clamping pressure is reached, the pressure valve interrupts the clamping movement of the upper beam.

The normal clamping pressure of the upper beam is:

F_{clamp} = 13488.54 lbf (60,000 N) (39.48 atm (40 bar))

With the 

auxiliary function selected (increased pressure), the clamping force of the upper beam is:

F_{clamp} = 47209.90 lbf (210,000 N) (133.23 atm (135 bar))

Note: When working with pressure-sensitive materials you should reduce the clamping pressure (see 6.3.2).

The controller continuously checks the parameter settings of the upper beam using the actual values from the two displacement measuring systems. If the difference between the two values exceeds a certain amount (see Save parameters), the upper beam will stop and the following message will appear on the screen:

This message is displayed when you have one-sidedly clamped a plate with s = 0,118 inch (3 mm).

How to resolve the problem:

- Insert a shim on the other side of the upper beam.
- Use the dimension-related clamping method.

This error message also appears when one of the two displacement measuring systems is not working.

Area of application:

- For safe clamping of all materials and thicknesses in the centre of the machine.
- For clamping thin sheets, whether centred or not.

Advantages:

- The clamping movement need not be programmed.
- The clamping movement can be at maximum speed (no delay ramp).

Disadvantages:

- One-sided clamping of thick plates not possible without using a shim.
- Short plates cannot be clamped in the centre of the machine.

Input:

- No input in the column (close upper beam); you may have to delete the entered value using the CL key.

6.3.2. Dimension-related clamping

Dimension-related clamping means that you enter the target position for the upper beam when it closes.

To do this, specify the plate thickness in the  column.

When entering the opening height, note the following:

Lower clamping pressures:	plate thickness plus about 0.004 inch (0.1 mm)
High clamping pressures:	plate thickness minus about 0.004 - 0.012 inch (0.1 - 0.3 mm)

You can also program a delay ramp for the clamping movement.
Before reaching the specified target position, the controller decelerates the clamping movement of the upper beam (see 6.9.1 Upper beam parameters).

Note: Maximum clamping pressure (47209.90 lbf (210,000 N)) is activated using the  soft key function in the auxiliary functions column (see also 6.6.4).

The specified closing height of the upper beam is adjusted using the two displacement measuring systems, ensuring that the closing movement is parallel and the upper beam cannot tilt.
In this case, the pressure switch does nothing.

Area of application:

- One-sided clamping of plates left or right.
- Clamping of short plates in the centre of the machine.
- Clamping of sensitive materials.

Advantages:

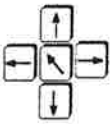
- The plate can be clamped on either side of the machine.
- Lower clamping pressures can be set using the clamping distance of the upper beam.

Disadvantages:

- The clamping time is longer because of the deceleration ramp.
- The clamping height of the upper beam must be specified.

Input:

We are in the program input level.

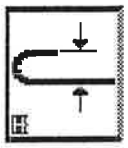
Use the cursor keys  to move the cursor to the  column.

Use the 10-key pad  to specify the required closing height.

Note: If you need the same closing height in all program lines, proceed as follows:

- .Enter the required closing height in the first program line.
- Press and hold the  key.
- Use the  key to copy the value into the subsequent program lines (see also 5.2.5 Copy value).

6.3.3. Closing beads



With this function and a specified closing height you can close a prefolded side (e.g. 135°) to a defined dimension.

The upper beam closes at normal speed up to a Save parameter value of 1.181 inch (30 mm). The closing speed then reduces to 60%; the upper beam closes parallel and cannot tilt.

Save parameter:	PORTION WAY:	1.181 inch (30 mm)
	SPEED PORT: (V):	0.236 inch (6.00)

Note: During the reduced closing movement, the upper beam may jump if the plate is not centred.

In the "Closing beads to a dimension" function, you must enter the position  (close upper beam) and activate the  auxiliary function.

If the normal clamping pressure of 13488.54 lbf (60,000 N) is not enough to close the bead, you must also select the 

auxiliary function.

Area of application:

- Closing beads to a defined dimension.

Advantages:

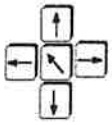
- The bead can be closed in any position.
- The upper beam is held parallel by the displacement measuring system throughout the closing movement.

Disadvantages:

- Slower clamping movement because the closing speed is reduced and a delay ramp is used.
- The closing position and auxiliary functions have to be programmed.

Input:

We are in the program input level.

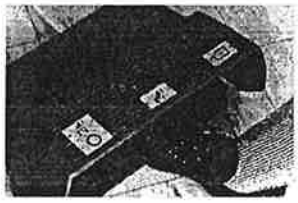
Use the cursor keys  to move the cursor to the  column - auxiliary functions for the program line.

Choose the  soft key function, and  if necessary.

Use the  cursor keys to move the cursor to the  column (close upper beam).
Enter the desired closing height (outer dimension of the bead).

Note: When running the bending program with the  function, you must briefly press the right foot switch (bending beam)

to continue program execution after the bead has been closed.
If you open the upper beam by pressing down fully on the middle (left) foot switch



the program will not continue to the next program line.

Notes:

6.4. Entering program information

It is a good idea to include plenty of information for the user in the bending program, especially if the operator is not the person who wrote the program. A well documented program makes it much easier for you to find the right programs on the diskette later.

In the Multibend 9000 controller, the program information is appended to the actual bending program in the form of a work plan. You can also integrate line-related information into the bending program (see 5.4.3 Copying text to program lines).

There are two sections of program information:

1) "Program information" contains detailed information about the bending program (see also 6.4.1).

2) "Upper, bending and lower beam configuration" provides information about the required tool configuration for the bending program (see 6.4.2 / 6.4.3 and 6.4.4).

Both of these sections of program information are automatically saved to diskette with the bending program (see 11.1.3 Saving and loading programs).

6.4.1. Program-related information

In the program input level, open the program information input window using the soft key.

```
PROGRAM INFO
NUMBER   :  A-123 M6-NLU
NAME     :  COVER

PCS.     :   30
FINISHED :  940322    (yymmdd)
STATUS   :   2

T * W * L: 0.059 * 29.528 * 66.929
STRENGTH :  50      ksi
MATERIAL :
INFO     :
VARNISHED SIDE FACING DOWNWARDS
```

The cursor starts off in the "Number" column when you choose the function.

Use the cursor keys to move the cursor from one input line to another

As soon as you see the soft key on the screen, you can invoke typewriter mode and enter text (see 5.3 Typewriter).

Use the keys to move the cursor within the input line.

This lets you insert spaces (blanks) in the text. In typewriter mode you can delete individual characters with the CL key or the entire input line with the CL LINE key.

If the typewriter soft key does not appear, you current situation only allows you to enter numbers from the 10-key pad

7 8 9
4 5 6
1 2 3
0

In input lines containing only numeric input options, delete false values with the CL key.

Exit the program information level by choosing the soft key function or pressing the key.

Explanation of the input lines:

Number: The drawing or part number of the component being folded. Up to 15 characters (alphanumeric) can be used. For example, A-123.456-ALU.

Name: The name of the program, max. 22 characters can be used. Examples: COVER, SIDE PANEL, HOUSING etc.

IMPORTANT: You cannot save a bending program to diskette unless you specify a program number or name. Programs without these details will not load from the diskette.

Count: The number of pieces.
The production control system can specify the number of pieces in the job. This is important in DNC transfers or centralised job allocation.
The maximum piece count is 99999.

Date: Input field for schedule planning. The production control system can specify the required production deadline. The FIND function of the diskette manager lets the user sort out the current deadline jobs (see 11.1.5 How to find programs). Enter the date in the format yymmdd. For example: 940322 = 22 March 1994.

Status: The urgency status for schedule planning.
For example:

1 - urgent (next job)
2 - normal job
3 - fill-in job
.
.
.
9 - parts fabricated!

This is an interesting option if the machine is DNC-linked. The operator writes to status 9 after completing the job to tell the production control system that the job has been completed.

Hint: If the specified piece count does not match the produced number, the operator can inform the production control system of the effective pierce count.

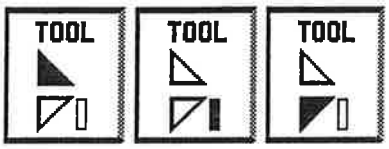
T x W x L: You can enter the required plate dimensions so that the operator can verify them.
T = plate thickness
W = plate width
L = plate length
The plate thickness is automatically used by the "Mathematic calculation aids" (see 6.2).

Strength: The tensile strength of the material being folded, in ksi (N/mm^2).
The strength value is used directly by the "Mathematic calculation aids" (see 6.2).

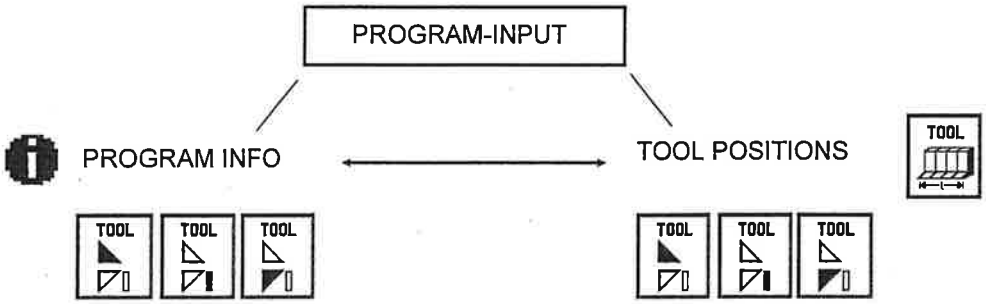
Material: Lets you enter a material number or designation. For example, ST 12.03.

Info: Input field for further important information about the bending program. For example, COATING FACE DOWN!

6.4.2. Basics of tool position



In these three levels you define the required tool configuration for the upper beam, bending beam and lower beam in the bending program.
The data of the three levels are automatically loaded and saved with the bending program (see 11. Program management).
The position of the bending tools in the program information is in direct association with the tool configuration level  of the program input level (see also 6.8 Tool positions (tool setup)), i.e. the two levels contain identical data.



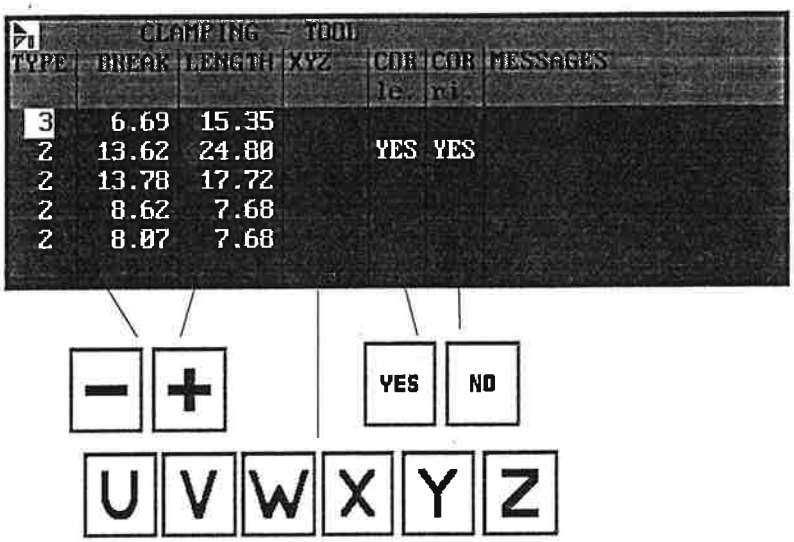
When a bending program is loaded from diskette, the stored tool configuration is automatically loaded too. In the  level the controller displays the tool setup graphically. If you change the tool setup in this level, the values in the program information are also automatically changed. The diskette still contains the "old program information".

By pressing the  and  keys simultaneously you can delete all values from the displayed window.

Use the  key to delete individual values within the input line.

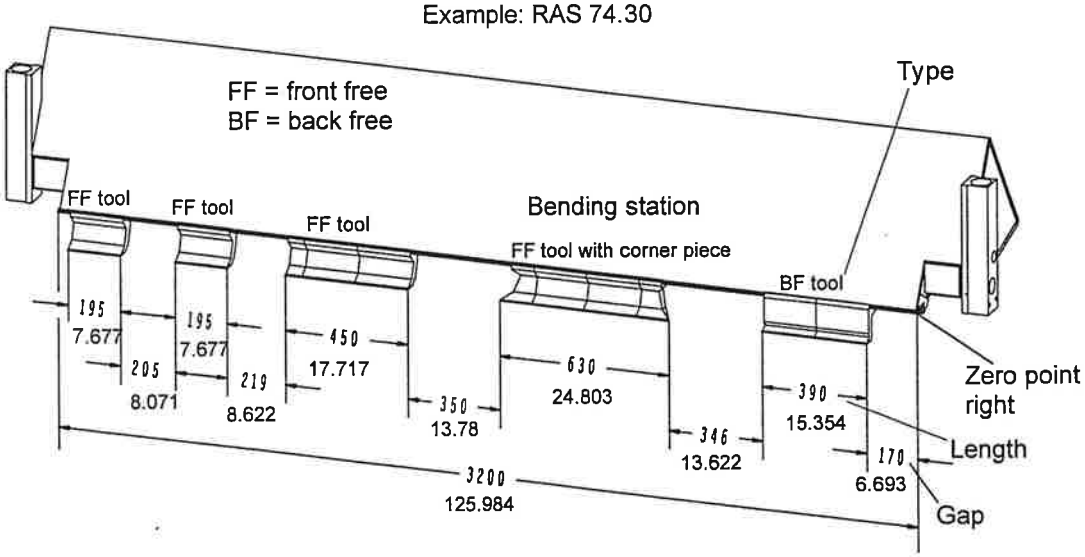
6.4.3. Upper beam tool position

Within the program information level  , choose the  soft key to display the upper beam tool position table.



You will see various soft keys on the screen, depending on the cursor position in the line.
You can enter up to 5 different tool lengths for the upper beam. All tool gaps and lengths are measured for each individual bending station. The tools used can also belong to different tool sets (see 9. Tool management).

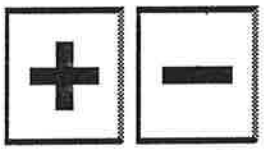
Example: RAS 74.30



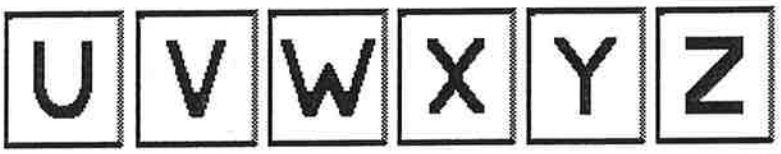
Explanation of soft keys:

If shown in reverse video, the zero point for establishing the gaps and lengths is on the left side of the upper beam.

If shown in reverse video, the zero point for establishing the gaps and lengths is on the right side of the upper beam (see figure above).



These soft keys are used to increase or decrease the gap or length by 0.197 inch (5 mm) with each press.

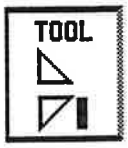


In a variable program, enter the variables which influence the tool length of the corresponding bending station (face end/side). The controller calculates the necessary tool length for the bending station. Please refer to the explanations under 6.8 Tool positions (tool setup) - in preparation!

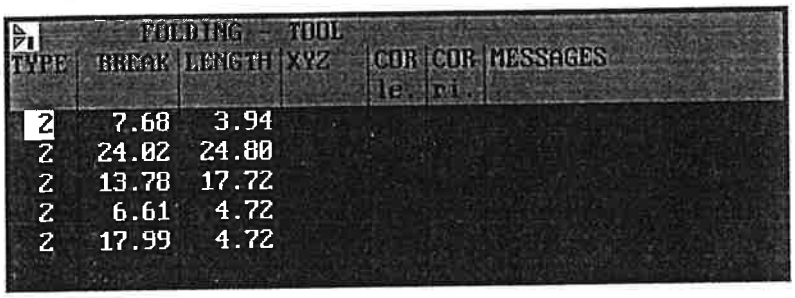
These two soft keys are used to specify whether or not to use corner pieces for the bending station.

Please also read 6.8 Tool positions (tool setup) for a more complete discussion of this level.

6.4.4. Bending beam tool position



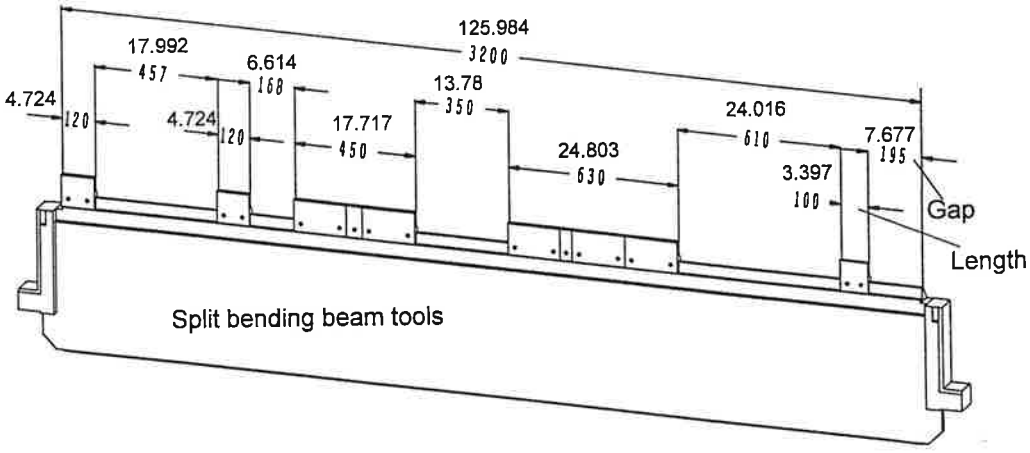
Within the program information level  , choose the  soft key to display the bending beam tool position table.



TYPE	BRIDGE	LENGTH	XYZ	COR le.	COR ri.	MESSAGES
2	7.68	3.94				
2	24.02	24.80				
2	13.78	17.72				
2	6.61	4.72				
2	17.99	4.72				

You will see various soft keys on the screen, depending on the cursor position in the line.
You can enter up to 5 different tool lengths for the bending beam. All tool gaps and lengths are measured for each individual bending station. The tools used can also belong to different tool sets (see 9. Tool management).

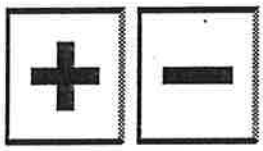
Example: RAS 74.30



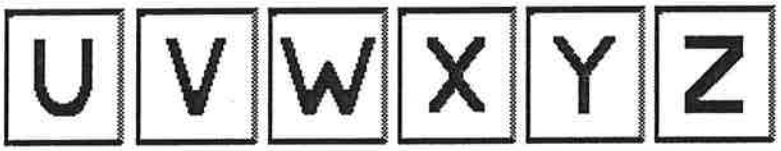
Explanation of soft keys:

If shown in reverse video, the zero point for establishing the gaps and lengths is on the left side of the bending beam.

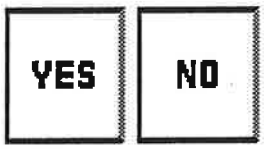
If shown in reverse video, the zero point for establishing the gaps and lengths is on the right side of the bending beam (see figure on page 6-28).



These soft keys are used to increase or decrease the gap or length by 0.197 inch (5 mm) with each press.



In a variable program, enter the variables which influence the tool length of the corresponding bending station (face and/side). The controller calculates the necessary tool length for the bending station. Please refer to the explanations under 6.8 Tool positions (tool setup) - in preparation!

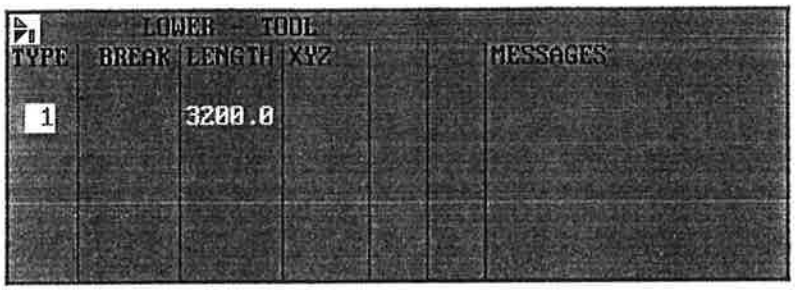


These two soft keys are used to specify whether or not to use corner pieces for the bending station.

Please also read 6.8 Tool positions (tool setup) for a more complete discussion of this level.

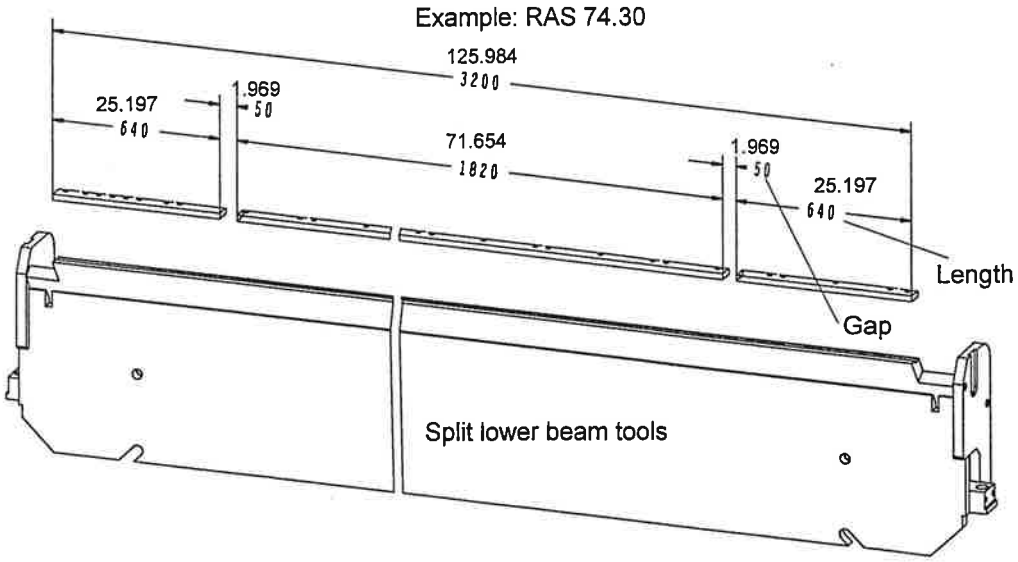
6.4.5. Lower beam tool position

Within the program information level  , choose the  soft key to display the lower beam tool position table.



You will see various soft keys on the screen, depending on the cursor position in the line.
You can enter up to 5 different tool lengths for the bending beam. All tool gaps and lengths are measured for each individual bending station. The tools used can also belong to different tool sets (see 9. Tool management).

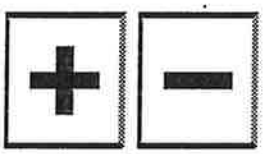
Example: RAS 74.30



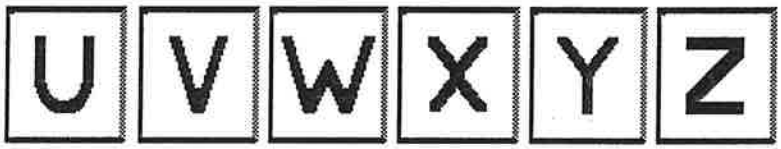
Explanation of soft keys:

If shown in reverse video, the zero point for establishing the gaps and lengths is on the left side of the lower beam.

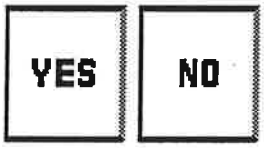
If shown in reverse video, the zero point for establishing the gaps and lengths is on the right side of the lower beam (see figure on page 6-32).



These soft keys are used to increase or decrease the gap or length by 0.197 inch (5 mm) with each press.



In a variable program, enter the variables which influence the tool length of the corresponding bending station (face and/side). The controller calculates the necessary tool length for the bending station. Please refer to the explanations under 6.8 Tool positions (tool setup) - in preparation!



These two soft keys are used to specify whether or not to use corner pieces for the bending station.

Please also read 6.8 Tool positions (tool setup) for a more complete discussion of this level.

Notes:

6.5. Information text in the program

You should include plenty of information in bending programs that you want to save and archive later, especially if the person using the program is not the person who wrote it!

When a bending program runs, the controller executes one line at a time. This process is indicated by the reverse-video display of the lines on the screen.
Text instructions will help the operator during work.

The info texts document program execution and make the programs easier to edit.

There are two different kinds of info text:

1) Line-related information (see 6.5.1)

2) Automatically displayed information (see 6.5.2).

6.5.1. Line-related information

You can include information text in each line of the bending program. The text can be up to 25 characters long. You should include plenty of documenting text in the program, as this will make the operator's job much easier when running the program.

Text when entering the program:

```
INFORMATION
LINE-INFO : DEVELOPD LENGTH !
B-ORDER   : SIDE     LENGTH
```

Displayed text when running the program:

```
DEVELOPD LENGTH !
B-ORDER   : SIDE     LENGTH
```

We have created a simple way of entering line-related information text. If you include only one stop position in the program line, the controller interprets the whole line as information text. When the program runs, the controller ignores this line. The text information is not shown during execution.

Example:

Bending program:

Info line	1		34.409 (874.00)				
	2	90.0	33.701 (856.00)	1.969 (50.00)	0.094 (2.40)	0.094 (2.40)	G
	3	90.0	32.677 (830.00)	1.181 (30.00)			
Info line	4		32.835 (834.00)				

Associated info texts:

1 DEVELOPED WIDTH
2 LONG SIDE 1 LEG (1)
3 LONG SIDE 1 LEG (2)
4 REST DEV. AFTER TURNING

Info text displayed during execution

You can use these information texts as comments for important dimensions (PLATE WIDTH, DEVELOPED WIDTH).

Note: You can also program several info lines in succession. The entered backstop position is ignored.

Entering line-related information:

The Multibend controller lets you do this in two ways:

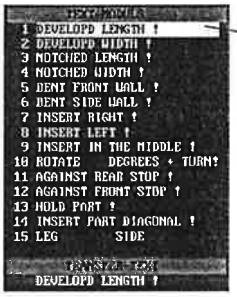
- Enter the text using text modules you created yourself.
- Enter the text using the soft key typewriter.

(Please read 5.4 Text modules)

Proceed as follows:

Once you have entered the program line or backstop position, use the soft key function to retrieve the text modules.

The cursor field is on the first line.



Cursor field

Use the cursor keys to select the desired text module from the 15 predefined texts.
The selected text is shown in the "Copy text" box.

When you exit the level with the soft key function, the selected text is copied as information text.

You can also create your own info text at any time. To do this, go to the text module level and choose the soft key function (see 5.3 Typewriter).

You will see letters displayed in the soft key bar, with the cursor in the "Copy text" box.

You can delete existing text with the CL LINE key.

To exit the typewriter, press the key.

You can copy the new text to the list of text modules with the INSERT soft key.

Note: You can also move an existing text module into the "Copy text" box and then edit it with the typewriter!

The soft key function copies the text to the program line as information text.

To exit the text module level or copy the info text to your program, use the EXIT soft key.

A detailed discussion of text modules is provided in section 5.4 Text modules.

An example:

In our example, move the cursor to line 1 of the program and press .

Move the cursor to "DEVELOPED WIDTH" and press .

The text then appears in the "Info" window.
Now move the cursor to line 2 of the program.
As the text "LONG SIDE 1 LEG (1)"! is not among the text modules, invoke the typewriter

TXT and enter the text.

Use to copy the text to the Info window for line 2. This does not modify the text modules.

You can create a text module as "LONG SIDE LEG " and then just enter the numbers before copying the line-related information to the program with .

6.5.2. Automatically displayed information

Information text is automatically displayed when you create a program, but this text cannot be edited or deleted; it is permanently stored in the controller.

INFO LINE

If you have entered **only one backstop position**, the following information is displayed:

This program line is ignored if you run the program with START or AUTO, i.e. the cursor skips to the next line. An entered information text (PLATE WIDTH) only serves to document the program for the writer or operator.

Backstop INACTIVE

If you enter **only one bending angle** in a program line, the following information is displayed:

When the program runs, this program line moves the backstop to its largest dimension and all backstop flaps are lowered. This provides you with the whole work surface, for example to work from markings.

End of program (PROG. END)

If you have entered **no bending angle** and **no backstop position**, the following information is displayed:

This program line is interpreted by the controller as the end of the program.

If the bending program was started with the AUTO key, the cursor automatically returns to the first line.
The piece counter reduces the number by one finished part and you can start work on the next part immediately.

Notes:

6.6. Auxiliary functions

The auxiliary functions perform the following tasks:

- Determine speed and pressure.
- Execute function sequences automatically.
- Display user information.

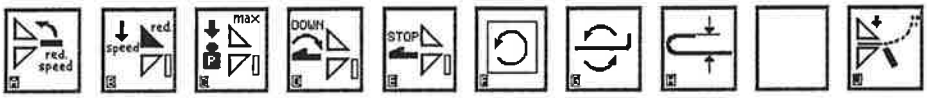
6.6.1. Fundamentals

You can select up to 11 different auxiliary functions in each program line.

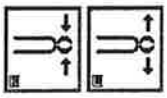
Enter the auxiliary functions in the  column. To do this, move the cursor with the ← → cursor keys into the Auxiliary functions column.

Note: The cursor movement will "wrap" around the columns on the screen. If the cursor is in the  column, you can press the ← key to move it directly to the  column.

The following soft key bar appears at the bottom of the screen, with all available auxiliary functions.



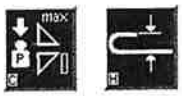
Switch to the background level with the NEXT key. The second set of soft keys is pink.



Pressing the NEXT key again returns you to the foreground set of soft keys.

Each soft keyicon is identified by a letter in its bottom left corner (from A to L).

When you invoke an auxiliary function by pressing a function key, the corresponding letter is entered in the program line. At the same time, the soft key icon appears in reverse video.



To reset an auxiliary function, press the corresponding function key once more. The soft key appears normally again (green or pink).

You can delete all selected auxiliary functions in a program line by pressing the CL key.

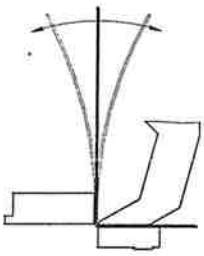
As soon as you start a bending program with START or AUTO, the controller displays the auxiliary function soft keys for each program line.

6.6.2. Reduced bending beam speed

This soft key function reduces the speed of the bending beam. The reduction only applies to program lines in which the soft key was activated.

Area of application:

If there are long sides protruding on the bending beam side, their weight may cause them to sag or flap.



Reducing the bending speed prevents this oscillating effect.

After choosing the  auxiliary function, the controller enters the letter "A" in the cursor field.

Note: The reduced bending beam speed is defined in the PARA DATA level (see 6.9.2 Bending beam parameters).

6.6.3. Reduced upper beam speed

You will need this auxiliary function in order to clamp plates from markings (without using the backstop). This involves the operator aligning the plate visually to the upper beam tool. Just before the upper beam makes contact with the plate is the best time to see whether the upper beam and marking are correctly aligned. Because the upper beam usually closes quickly, it leaves no time to react and stop the beam with the foot switch if the alignment is wrong. This problem is solved by the "Reduced upper beam speed" auxiliary function.

This auxiliary function has the following advantages:

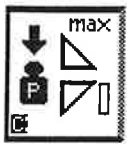
- The speed is reduced **only** when the beam is close to the plate. Long distances are covered just as quickly as they would be without using this function.
- The function can be used in individual program lines. The closing speed of the upper beam is thus only reduced when this is really necessary.
- The opening speed of the upper beam is not changed.
- The closing path at reduced speed is defined by a parameter, as is the closing speed.

After you have selected the  auxiliary function, the controller enters the letter "B" in the cursor field.

IMPORTANT: To use this function, you must define the two parameter values "SPEED red." and "DIS red. SPEED" in the **PARA DATA** level.

For details on entering the parameters, see 6.9.1 Upper beam parameters.

6.6.4. Increased upper beam pressure



Use this auxiliary function to increase the upper beam clamping pressure from 30.4 atm (30 bar) to 131.72 atm (130 bar).

Area of application:

- For closing beads.
- For securely clamping long plates with maximum plate thickness.

In all other cases, there is no need to increase the clamping pressure.

ATTENTION: If the clamping pressure is applied to small surfaces areas in the centre of the machine, this may eventually damage the upper and lower beams!

In RAS folding machines, the clamping pressure adjusts automatically to the bending force. This means that at the normal pressure of 30.4 atm (30 bar), the upper beam holds clamped plates securely and reliably during bending. The increased clamping pressure of 131.72 atm (130 bar) is only required when you have a combination of a thick plate and a long bending length.

Sensitive plates such as sheet copper or aluminium may require a lower clamping pressure. Please refer to section 6.3.1 Pressure-related clamping.

After you have activated the  auxiliary function, the controller enters the letter "C" in the cursor field.

Description of functions:

When you use increased clamping pressure, the upper beam starts closing at the normal pressure of 30.4 atm (30 bar). Once the clamping position of the beam has been detected by the pressure switch integrated into the hydraulics, it automatically switches over to the increased pressure setting.
The clamping pressure is maintained over a fixed clamping pressure period of about 2 seconds. After this period the clamping movement is stopped by the appropriate flow-dividing valves. This procedure protects the hydraulic system and motor against overloading. In "dimension-related clamping" (see 6.3.2), the clamping movement is not stopped until the clamping position is reached, even if the increased clamping pressure has not yet taken effect. In this case, displacement measurement is given priority.

6.6.5. Lower backstop flaps

Use this auxiliary function to:

- prevent the backstop from pushing the plate forwards out of the machine when you change from large to small backstop settings.
- produce a clear surface for turning the plate.
- prevent the backstop from pushing the plate forwards.

This auxiliary function is always performed at the beginning of a program line, so you should include it in the line in which the plate might be pushed out.

Note: If the backstop is positioned close to the bending edge, the backstop flaps may collide with the upper beam tools if the upper beam has not been opened far enough. The Multibend 9000 controller recognises these potential collisions automatically.
The backstop flaps are automatically lowered before the new backstop position is set, and automatically raised again at the backstop position. The auxiliary function need not be selected specially for this purpose.

If you are working from markings, you don't need the backstop. Enter an angle in the  column of the relevant program line; do not enter a dimension in the  column. When the program runs, the backstop will move to its largest setting and lower its flaps automatically. The  auxiliary function need not be specially selected to do this.

After you have activated the  auxiliary function, the controller enters the letter "D" in the cursor field.

How it works:

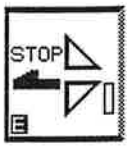
When the bending program is running, the backstop flaps will drop to below work surface level before moving to the new backstop position. The flaps stay down even after reaching the backstop position, and you can move the part around on the work surface without interference.

Briefly pressing the "Close upper beam" foot switch

raises the backstop flaps again.

The middle (left) "Close upper beam" foot switch is used primarily for closing the upper beam, but also for other minor functions, which are activated by just briefly pressing the switch instead of putting your foot firmly down. In the case above, we have used it to raise the backstop flaps. So don't press you foot all the way down, as otherwise the upper beam will close (as well as raining the flaps) and you will not have time to align the plate properly.

6.6.6. Stop backstop



Use this auxiliary function to prevent the backstop from automatically moving to the next position.

Uses:

- To remove a part from the backstop area before the backstop automatically moves to the next position.
- To prevent the plate from being ejected when changing from large to small backstop settings.

How it works:

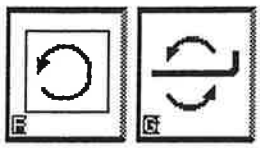
The backstop remains at its last position although the controller has moved on to the next line. You now have time to move the workpiece.

As soon as you briefly press the right "Bending beam" foot switch

the backstop is moved to its next programmed position.

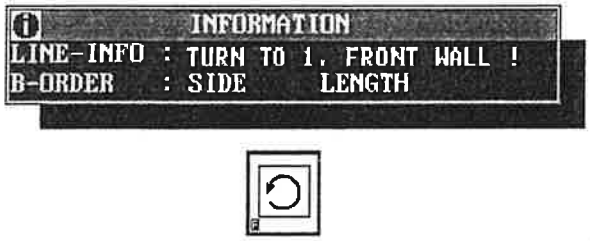
After you have activated the  auxiliary function, the controller enters an "E" in the cursor field.

6.6.7. Turn and reverse plate



These two auxiliary functions are only for providing information to the user when the program is running.

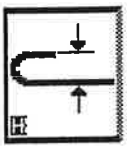
The soft keys are displayed on the screen in the appropriate program line. If you add additional information text (see 6.5.1 Line-related information), you can provide the operator with useful information during work.



The codes entered in the auxiliary function field by the controller are an "F" for "Turn plate"

 and a "G" for "Reverse plate"  .

6.6.8. Produce hollow beads



Use this auxiliary function to close folded sides up completely or down to a predefined dimension.

The two displacement measuring systems for the upper beam guarantee parallel clamping, so you can close beads outside the centre of the machine.
When this auxiliary function is applied, the bending beam cannot be started with the left foot switch.

Programming:

Before closing a bead, you must fold the side to about 135°. You can then close the bead in the next program section.

ATTENTION: When folding the side over, make sure you know the maximum bending angle of your tools. Also check the mechanical safety shutdown on the left side of the machine.

Here is a programming example with backstop positioning to close the bead. First we run the backstop about 0.236 inch (6 mm) further back. The bead remains open about 0.079 inch (2 mm) (plate thickness 0.039 inch (1 mm)).

Note: If you want to close up the bead completely, you may need the  auxiliary function.

After you have activated the  auxiliary function, the controller enters an "H" in the cursor field.

Running the program:

Pre-fold the bead, then position the plate below the upper beam. Run the program line (3) to close the bead by pressing the left "Upper beam" foot switch. The upper beam moves to the specified dimension, 0.157 inch (4 mm).

If you start the program with AUTO, you must now briefly press the right foot switch. The upper beam opens and the controller automatically moves on to the next program line.
If you open the upper beam with the left "Upper beam" foot switch, the controller will not continue with the next program line.

How it works:

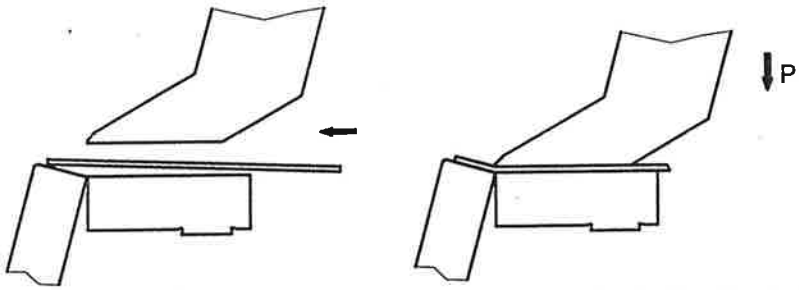
The parallel guide of the upper beam engages about 1.575 inch (40 mm) (see Save parameter Section distance) before the clamping position of the upper beam.
If the load is off-centre, the side with less load is halted in impulses during closing. The switching peaks make a slight pulsing or stuttering noise, which has no adverse effects on the machine.
Throughout the parallel motion the speed of the upper beam is automatically reduced to 30-40% (Save parameter SPEED SECTION (V)).

6.6.9. Mark bending (bend segments)

The Mark bending auxiliary function is used with thin plates to:

- produce large radii through individual bending segments.
- mark on diagonal bracings (e.g. ventilation ducts).

The bending beam is set to a bending angle between 1 and 25°. The plate is deformed by the clamping force of the upper beam.



The advantage of this bending method is that it saves time because the bending is done by the closing of the upper beam.

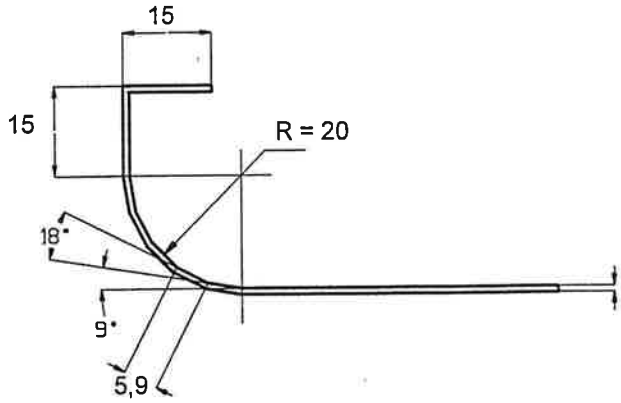
Programming:

Each marking movement requires its own program line.
If a radius consists of 5 segments, you must enter 6 program lines.

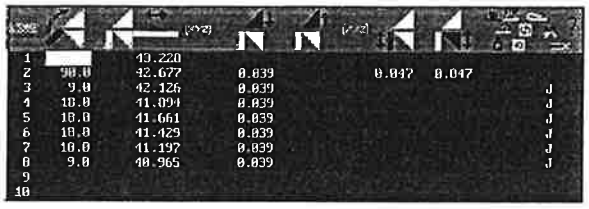
Example:

Radius R20 formed from 5 segments (sheet thickness 0.039 inch (1 mm)).
The drawing shows a segment length of 0.232 inch (5.9 mm). The first and last bending angles are 9°, with 4 x 18° in between.

ATTENTION: Position of the bending beam during mark bending max. 25°



Program input:



1		43.220				
2	90.0	42.677	0.039	0.047	0.047	
3	9.0	42.126	0.039			J
4	10.0	41.094	0.039			J
5	10.0	41.661	0.039			J
6	10.0	41.429	0.039			J
7	10.0	41.197	0.039			J
8	9.0	40.965	0.039			J
9						
10						

Note: To convert the side length to the effective backstop position, use the  function (see 6.2.1 Converting side lengths to the backstop position (dimension increment).

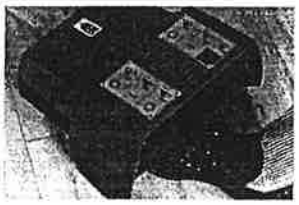
IMPORTANT: The bending angles can be corrected using the specified bending and lower beam adjustment (example 0.047 inch (1.2 mm)).

Running the program:

Start the program with AUTO "Auto start", i.e. the program automatically executes one line after the other. Bend the 90° leg, then mark bend the rest.

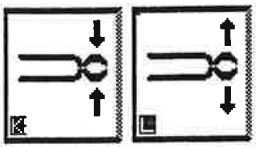
ATTENTION: For safety reasons you must start the outward swing of the bending beam, when the upper beam is open, using the right "Bending beam" foot switch.

Then leave your foot down on the left "Upper beam" foot switch.



The machine will automatically bend all subsequent segments. In this process the upper beam opens, the plate is advanced, and the upper beam closes again. There is no need for you to intervene.
After the final segment the upper beam opens automatically and the bending beam swings back to 0°.

6.6.10. Locking and releasing the clamps



Use the NEXT key in the  column to activate the two auxiliary functions.

The soft keys in the background level appear on a pink background.

Press the NEXT key once more to switch back to the foreground soft keys.

The two soft key functions only take effect if you have an optional add-on facility installed in the machine, with the backstops configured as grips.

Further information on request!

6.7. Piece counter

The Multibend 9000 controller has a programmable piece counter. This function gives the user an overview of parts that have been finished or have yet to be finished.
The piece counter is used mainly in series production.

How it works:

When the CNC controller reaches the last program line during program execution, it automatically returns to the first line and counts one piece.

Remember:

- To use the piece counter, you must start the program with the AUTO function.
- A bending program can consist of two different parts.

Part 1	(door track)	from program line 1 to 19
Part 2	(cover)	from program line 20 to 35

If one program section follows the other without an empty line between them, the controller will count only one finished part: a complete door.

There are two ways to enter the piece count:

1) Enter it directly using the  soft key function.

2) Enter it indirectly via program information  . The piece count is already specified in the "COUNT" line.
This can be done during program input and as part of work preparation.

IMPORTANT: The two piece count inputs are directly linked to each other.
- As soon as you change one input, the other also changes automatically.
- When the program runs, the reduced piece count is automatically entered in the program information.

6.7.1. Adding piece counter

The adding piece counter always counts completed program cycles (finished parts) in ascending order of numbers (0, 1, 2, 3, ... etc.).

Exercise:

You have a stack of punched plates on a pallet. So that you know exactly how many parts you have completed when you finish the stack, activate the adding piece counter.

Proceed as follows:

Load the required program from diskette with the  function (see also 11.1.3).

Change from the main menu to program input level using the PROG EDIT soft key function.

If the "COUNT" line in the  Prog. Info level already contains a number, the following entries will appear in the Count column:

If there is no piece count in this column, you can begin work immediately. The piece counter adds one finished part after each cycle.

Resetting the piece count:

Press the  soft key. The cursor field for entering the piece count appears on a white background.

Exit piece count input with the  or  without having entered a value.

The piece counter has now been reset and you can begin work.

6.7.2. Programmable piece counter

Let us use two examples to illustrate the options provided by the programmable piece counter.

Exercise A:

You want to work through a stack containing an unknown number of plates and determine the number. After you have completed 25 plates, an urgent job interrupts your work. You have been using the adding piece counter. To remember later how many parts you have completed, you make a note of the 25 finished parts.

Proceed as follows:

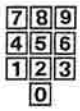
Load the interrupted program into memory using the  soft key function in the diskette management level (see 11.1.3).

Choose the 

soft key function to go from the main menu to the program input level.

Press the 

soft key to go to piece count input.

On the 10-key pad 

, enter the number of parts already completed (25).

Exit piece count input with the  or 

soft key function.

You now see the number 25 on the screen. After each completed part the controller will increment the count by one.

Exercise B:

From a stack of plates, you want to use exactly 50.

Proceed as follows:

Load the required bending program from the diskette manager with the function (see 11.1.3).

Choose the PROG EDIT soft key function to go from the main menu to the program input level.

Press the n soft key to go to piece count input.

On the 10-key pad 7 8 9 / 4 5 6 / 1 2 3 / 0 , enter the number "-50".

Note: You must first enter the number, then use the key to enter a minus sign.

Exit piece count input with the or ENT soft key function.

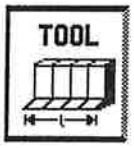
You will now see the following lines on the screen:

LINE			Pieces
1	INFO	LINE	-50

After each completed program cycle, the controller adds a finished part to the total, i.e. -49, -48, -47 ... etc.

When the counter reaches zero, the controller automatically goes to STOP and interrupts work. You have now completed exactly 40 parts.

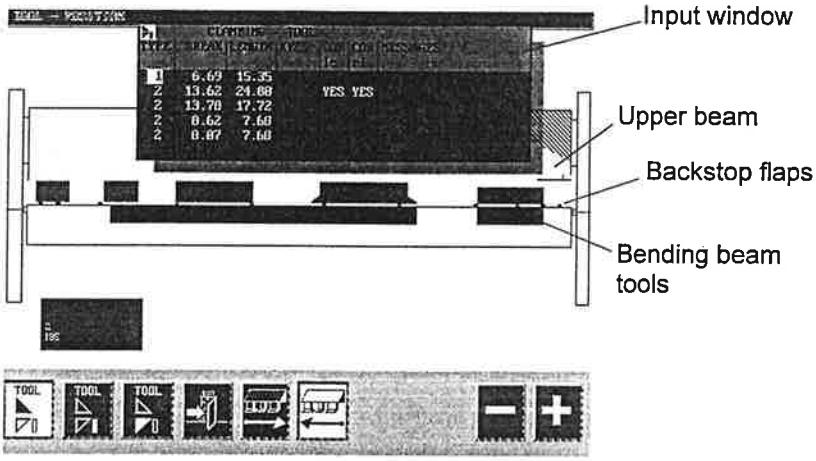
6.8. Tool positions (tool setup)



6.8.1. Fundamentals

From the  program input level, change to the tool position level with the  soft key function.

In this level the controller shows you the machine's tool setup in a graphical form. When you enter this level, the upper beam setup is always active.



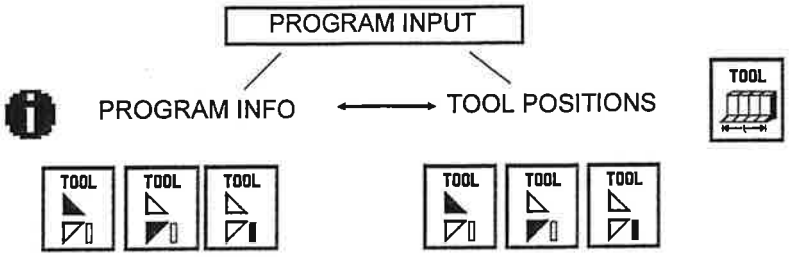
The controller receives the data for the graphic tool setup from:

1) the tool definition in the program information (see 6.4.2 to 6.4.5).

2) your direct inputs in the individual tool input windows (see 6.8.2 to 6.8.4).

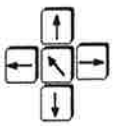
3) the tool manager (see 9. Tool management). Without the data of the individual tool sets, the tool setup will not be displayed.

IMPORTANT: The two levels  and  always access the same data record, i.e. if you change a gap dimension in level  for example, the controller will automatically change this dimension in level 



When you load a bending program from diskette that has a tool setup entered in the program information, the  level will immediately show you the tool setup data in the input windows. You need this tool setup to process the loaded bending program.

If you have written a program but not yet defined a tool setup, you can do that in this level. The advantage is that you have a graphical display of the configuration of the tools and backstop flaps. The data are automatically copied to the program information.
When you save the bending program to diskette, the tool setup data are automatically saved in the program information.

Use the cursor keys  to move the cursor around in the input window.

Use the  key to delete the contents of the cursor field.

Use the  key to clear the entire input line containing the cursor.

Use the  and  keys simultaneously to clear the contents of the entire input window containing the cursor.

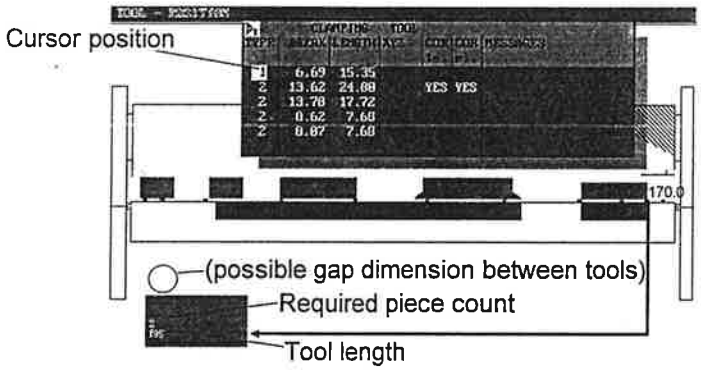
Use the  soft key function to exit this level and return to the program input level.

6.8.2. Upper beam tool position

From the 

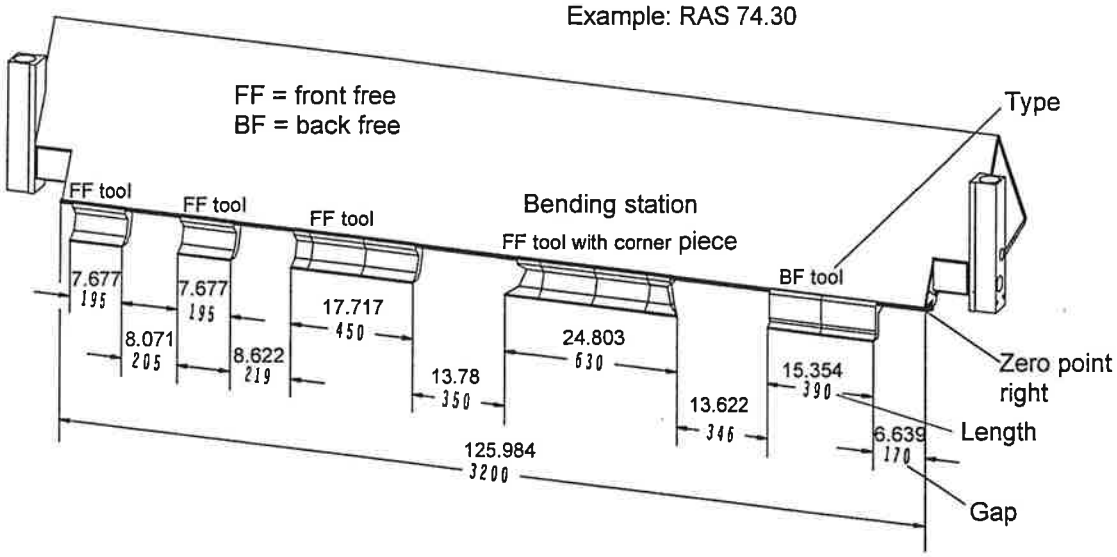
tool position level, the 

soft key function takes you to the input window for the upper beam tool setup. After opening the input window, the cursor is always in the first input line and the first column, "TYPE".
The bending station for this line is shown in green in the graphical display. All other bending stations appear in dark blue.



2 x 7.677 inch (195 mm) = 15.354 inch (390 mm) tool length

You can enter up to 5 different tool lengths for the upper beam. All gap and length dimensions are measured separately for each bending station. The tools used can also belong to different tool sets (see 9. Tool management).



Explanation of the columns and soft keys:

Use the  cursor key to move the cursor to the first input line.

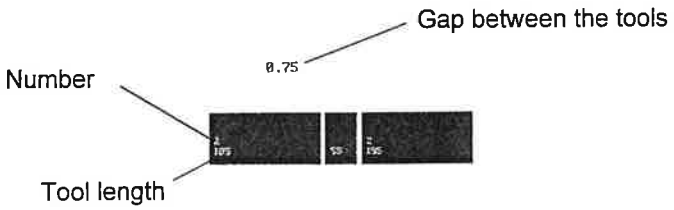
In the **"TYPE"** column, enter the number of the required tool set. If you can't remember the tools from the various tool sets off-hand, you can look at them in the 

level (see 9. Tool management).
In the **"GAP"** column, enter the gap dimension, measured from the outer edge of the upper beam.
Enter the required tool length in the **"LENGTH"** column. Exit the input column with the cursor keys, or choose 

. You will immediately see a graphical display of the tool length and position.

The controller also calculates:

- the required numbers of the individual tools
- the length of the tools
- the gaps between the tools, if necessary.

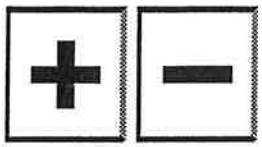


You can adjust a displayed gap dimension using a feeler gauge or with prepared strips of sheet metal.

This soft key function sets the datum for setting up the tools on the left side of the upper beam. All gaps and length are measured from left to right.

This soft key function sets the datum for setting up the tools on the right side of the upper beam. All gaps and lengths are measured from right to left.

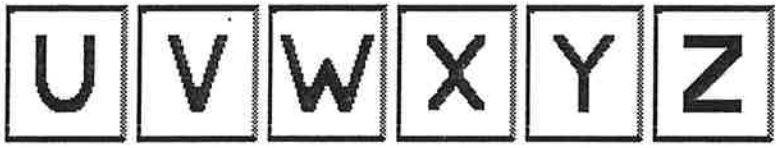
Note: The active soft key is always the one shown in reverse video (white background). After entering all tools, you can set the datum to the other side. The controller then automatically displays the other tool setup.



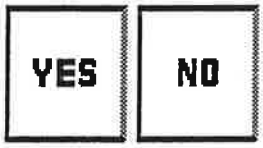
These two soft key functions increment or decrement an entered gap or length dimension by 0.197 inch (5 mm) each time the key is pressed.

Example: You have entered the desired tool length, but there are at least two backstop flaps to which you cannot align the workpiece. Move the cursor to the "gap" dimension in this line and move the tool block with this soft key function.

The **"XYZ"** column is where you assign a variable to the bending station. This is only necessary if you enter and use the bending program as a variable program. In this case, the controller accounts for the entered variable of the  level (see 10. Variable programs) and calculates the required length for the bending station.

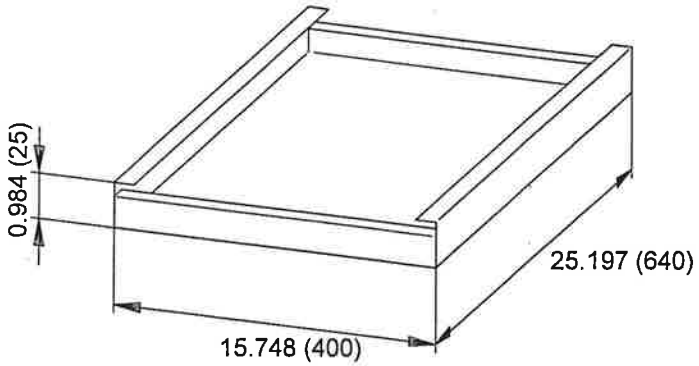


Use these soft keys to enter the variables which influence the tool length of the station. In preparation!



These two soft keys are used to activate or clear the corner piece entry.

Example:



In the two columns **"CORNER l"** and **"CORNER r"** you tell the controller whether you need corner pieces for the bending station.
If the part you are bending has sides facing inwards, you will need corner pieces (see figure above).

Note: As soon as you enter a corner piece, the controller automatically calculates the new tool setup from the available pieces and displays it graphically.

Please refer to section 6.8.5 Info column messages for an explanation of the "MESSAGES" column.

IMPORTANT: If you need to install an upper beam tool with a different height for your program, you **must** re-calibrate the machine.

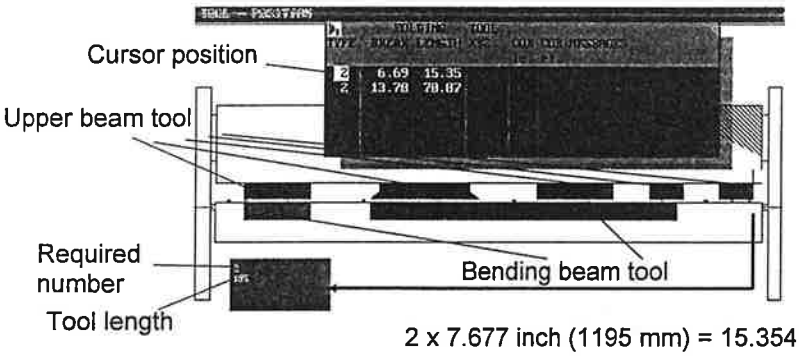
6.8.3. Bending beam tool position

From the 

tool position level, use the 

soft key function to go to the input window for the bending beam tool setup.
After opening the input window, the cursor is always in the first input line and the first column, "TYPE".
The bending beam tools for this line are shown in green in the graphical display. All other bending stations appear in pink.

Example: Setup for a split bending beam tool length:



2 x 7.677 inch (1195 mm) = 15.354 inch (390 mm) tool length

ATTENTION: Remember to make allowance for the increased height of the bending beam tool (e.g. 1.378 inch (35 mm)) in the input colum  bending beam adjustment. Use the plate thickness and the 

soft key to determine the bending beam adjustment, and then add the increase in the height of the bending beam tools.

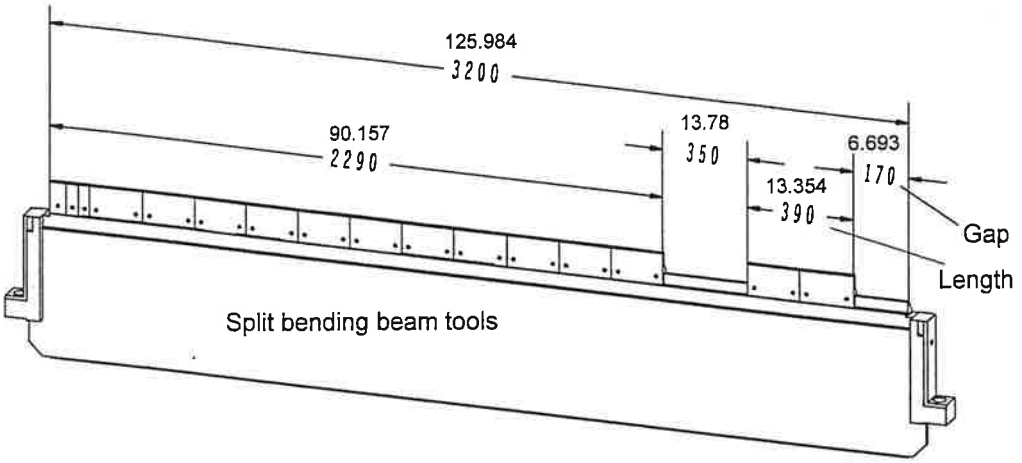
Example for a program line:

0.039 (1.0) (plate thickness) + 

+ height increase of bending beam tools

You can enter up to 5 different tool lengths for the bending beam. All gap and length dimensions are measured separately for each bending station. The tools used can also belong to different tool sets (see 9. Tool management).

Example: RAS 74.30



The various columns and soft key functions are explained in section 6.8.2 Upper beam tool position.
The input sequence and soft key functions for the bending beam tools are the same as for the upper beam tools.

You can enter corner pieces for the bending beam tools as you can for the upper beam tools. These corner pieces are displayed graphically by the controller.

Input line for a continuous bending rail:

The controller displays the whole bending rail graphically.

Please refer to section 6.8.5 Info column messages for an explanation of the "MESSAGES" column.

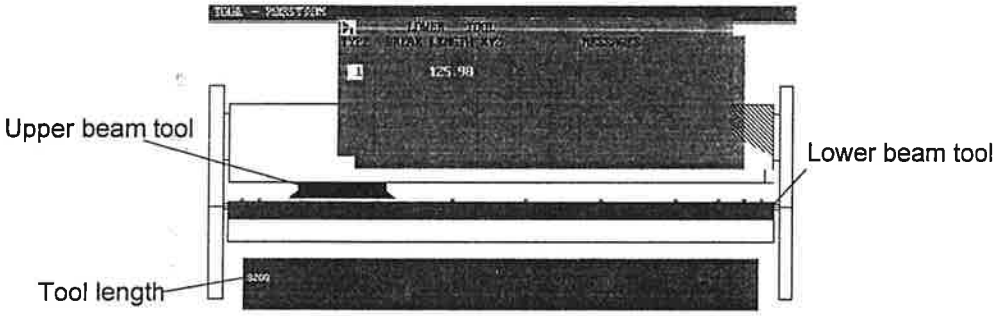
6.8.4. Lower beam tool position

From the  tool position level, use the  soft key function to go to the input window for the lower beam tool setup.

After opening the input window, the cursor is always in the first input line and the first column, "TYPE".

The lower beam tool of the first input line appears in green on the display. If the lower beam tools are split, all other lengths are shown in yellow.

Example: setup for a continuous lower beam rail:



The various columns and soft key functions are explained in section 6.8.2 Upper beam tool position.

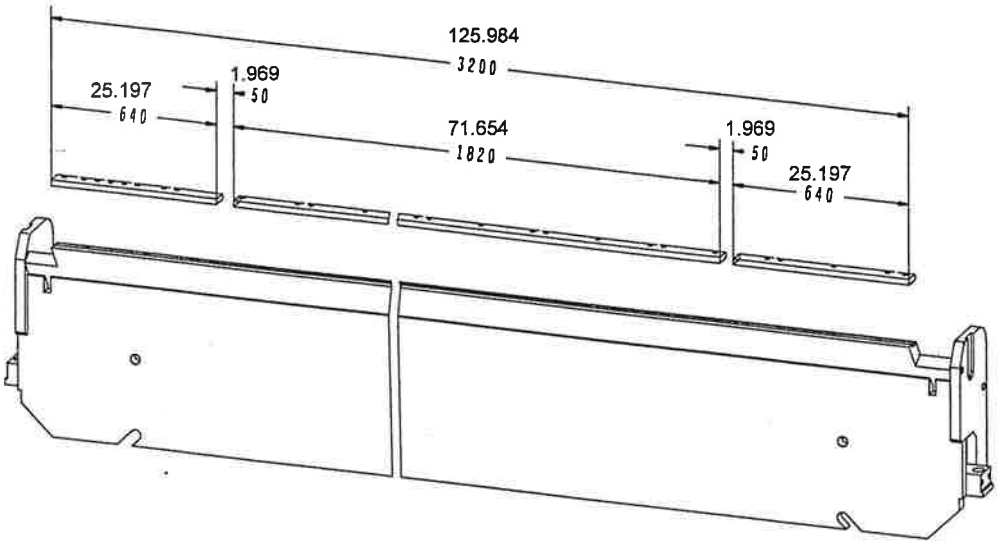
The input sequence and soft key functions for the lower beam tools are the same as for the upper beam tools. There are no corner pieces for the lower beam tools, so these input columns have no function.

Special case:

For special applications a split lower beam rail may be necessary, for example with Z-bends on the bending sides.

Input example:

In our example we have a lower beam rail that is split in three:



Note: The lower beam tool can also consist of block and adaptor tools.

Please refer to section 6.8.5 Info column messages for an explanation of the "MESSAGES" column.

6.8.5. Info column messages

The "MESSAGES" column provides important information while you are entering the individual tool lengths for the upper, bending and lower beams.
When you enter values with which the controller is not able to perform calculations, a message is displayed in the column.

Explanation of the messages:

Gap too big

When calculating an entered tool length, the controller accounts for a maximum gap width (0.394 inch (10 mm)). If the calculation produces a bigger gap than this, the "Gap too big" message is displayed.

Reasons:

- There are not enough pieces left for the desired tool setup. Go to the TOOL tool management level to check the number of block and adaptor pieces in the selected tool set.
- No tools have been defined in the selected tool set. Make sure you have entered the correct tool set number.

No left corner

You have entered a tool set number in the "TYPE" column. You want to use corner pieces to set up the tool length in the same input line. The message "No left corner" appears.

Reason:

No left corner piece is defined in the selected tool set in the tool manager TOOL.

No right corner

You have entered a tool set number in the "TYPE" column. You want to use corner pieces to set up the tool length in the same input line. The message "No right corner" appears.

Reason:

No right corner piece is defined in the selected tool set in the tool manager TOOL.

Beam exceeded

When you entered the last gap or length dimension, you exceeded the length of the upper, bending or lower beam. Check the last entry and correct the dimension.

Notes:

6.9. Parameter data

Examples of parameters are:

- speeds,
- limit values and
- conversion factors.

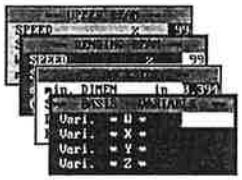
Each bending program has its **own** parameters, which are stored with the bending program when you save the program to diskette.

Parameter values can be entered in the following levels:

program input and  technical specifications.

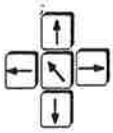
Select parameter input with the 

soft key function.



The controller first shows the input window for the upper beam. Use the 

soft key function to advance to the other input levels.

To enter a parameter value, use the cursor keys  to move the cursor to the desired line, then enter the values using the 10-key pad.

You can correct mistakes with the 

key. The controller automatically enters a default value, which can change by simply overtyping it.

If you accidentally enter a value that is too high or too low, a message window will appear.

Minimum value Maximum value

You cannot move the cursor or exit the parameter level until you have corrected the value.

Exit the level with the  soft key function or the  key.

6.9.1. Upper beam parameters

** UPPER BEAM **		
SPEED	%	99
SPEED red.	%	30
WAY SPEED red.	in	0.394
min. STROKE	in	0.276

SPEED: Set the upper beam closing speed in %.
99% = 1.772 inch/sec (45 mm/sec).

SPEED red. Reduced upper beam closing speed in %.
The reduced speed is only active in program lines in which you have activated the  auxiliary function.

Function:

The upper beam comes down at normal speed (see SPEED). When the "SPEED WAY red." parameter is encountered, the controller automatically switches to the reduced speed.

Example of application:

When working from markings, or to improve alignment during clamping.

WAY SPEED red. Define the opening distance at which the controller is to switch to the reduced upper beam closing speed.
This dimension is measured from the lower beam contact surface.

The parameter only takes effect in combination with the "SPEED red." parameter, i.e. it is only effective in the program line in which you activated the  auxiliary function.

Advantage:

It saves time because you need not do the whole upper beam movement at reduced speed.

min. STROKE This parameter defines the upper beam opening after a bending step. If you did not enter a value in the  column, the "STROKE min." parameter automatically takes effect.
The lowest input value is stored in the Save parameters, and depends on the backstop flaps.

Advantage:

You do not need to enter an opening height for every program line.

6.9.2. Bending beam parameters

```
** BENDING BEAM **
SPEED              %     99
SPEED red.         %     30
max. ANGLE       Deg  135.0
COR.ALL ANGLE    Deg
```

SPEED:

Set the bending beam speed in %.
The parameter only takes effect when the bending beam swings upwards.
99% = 2.756 inch/sec (70 mm/sec).

Advantage:

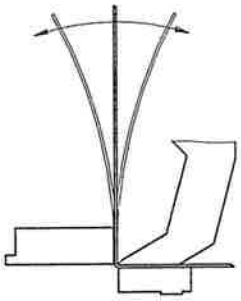
The speed at which the bending beam is lowered is not reduced (2.756 inch/sec (70 mm/sec).).

SPEED red.

Reduced bending speed in %.
The reduced speed is only active in program lines in which you have activated the  auxiliary function.

Advantage:

- It prevents long bending sides from "overshooting" if they are hanging unsupported beyond the bending beam tools.



- It saves time. You can use the "Reduced bending beam speed" auxiliary function in specific parts of the program. In the rest of the program the bending beam will move at the normal speed defined by the "SPEED" parameter.

max. ANGLE

The maximum bending angle of the bending beam. This angle is determined by the currently installed upper beam tool.

ATTENTION: Check this parameter when changing the upper beam tools. You must do this if you have upper beam tools with different geometric shapes!

Note: On the left-hand rotary piston cylinder is a mechanical safety device for setting the maximum bending angle. When you change the upper beam tools, check this safety facility too!

COR.ALL ANGLE Deg.

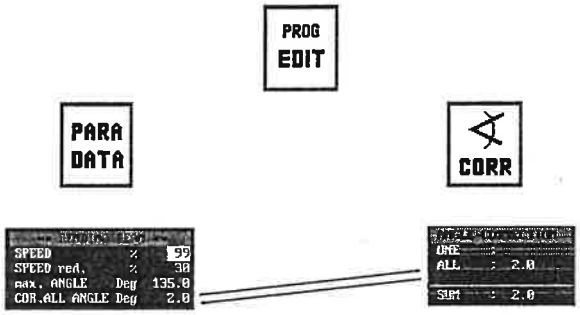
This parameter is a correction value for the bending angle and corresponds to the spring-back angle of the material.
The correction factor is automatically accounted for in all bends performed by the program.

Input example: SHEET SPRING deg. 2
All bending angles in the program are 2° larger.

SHEET SPRING deg. -1.5
All bending angles in the program are 1.5° smaller.

Note: First enter the number 1.5, then add the minus sign with the key

The entered value is automatically shown in the "ANGLE CORR." window (see 7.1 Angle corrections). Conversely, values in the "ALL" input line are copied directly to the "SHEET SPRING deg" bending beam parameter.



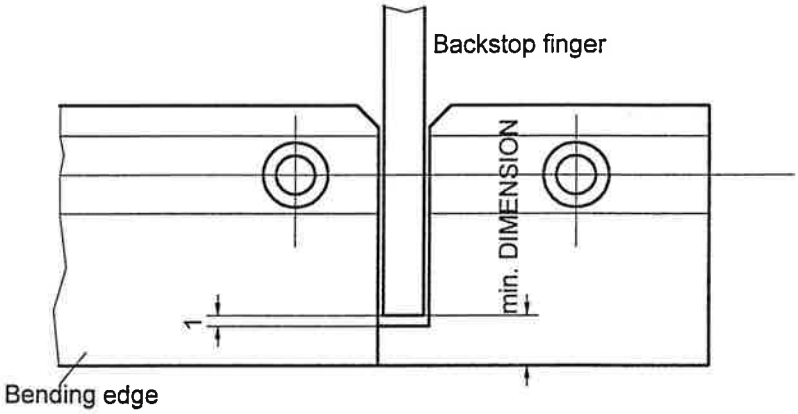
6.9.3. Backstop parameters

```
** BACKSTOP **
min. DIMEN      in  0.394
SPEED           %     99
DIMENSION COR. in
POS by FB-CLOSE
```

min. DIMEN

The backstop can run a maximum distance forward, depending on the installed lower beam tool.

The "min. DIMENSION" is determined by the backstop pockets in the lower beam tool and must be 0.039 inch (1 mm) larger than the recess.



The controller checks your "min. DIMENSION" input using the Save parameter values.

min. dimension	(min)	0.394 inch (10.0 mm)
max. dimension	(max)	1.965 inch (49.9 mm)

ATTENTION: You **must** adjust this parameter after changing the lower beam tools!

SPEED

Set the backstop positioning speed in %.
99% = 7.874 inch/sec (200 mm/sec).

DIMENSION COR.

Depending on the upper beam tools used, positions may shift as a result of different degrees of wear on the upper beam tools. These dimensional differences can be compensated with the ADJ. POS. parameter (see 7.4 Line-related backstop corrections).

Note: A general backstop correction is performed in the Save parameters with the calibration dimension of the backstop.

POS by FB-CLOSE

This parameter has no function.

6.9.4. Basic variables

** BASIS VARIABLE **		
Vari.	* W *	
Vari.	* X *	13.071
Vari.	* Y *	33.150
Vari.	* Z *	4.193

This parameter window is only required when you are creating a variable program.

You assign the declared variables to the  basic dimensions level, using the dimensions of the variables at the time the program was written.

These basic values enable the controller to convert the modified backstop positions of a variable program back to the original backstop positions of the time before the variable program was created.

Please refer to section 10. Variable programs for a discussion of how to create variable programs

.Notes:

6.10. Input hints

We have put together a few hints and tips for you on how to speed up inputs.

Task/problem	Hint (How?)	Refer to
• Enter values quickly	Use the "Copy value" function so that you only have to enter a value once.	5.2.5
• Enter program lines quickly	Copy or move program lines using the editor auxiliary functions.	5.2
• Enter side lengths directly and have them converted to the backstop position	Use the "Dimension inc." math function to find the effective backstop position.	6.22.1
• Determine the BB and LB adjustments	Use the "S x factor" FAKTOR and "Math" functions to find the optimum adjustment values.	6.2.2 6.2.3
• Correct angles without changing the setpoint value	• Change the "SHEET SPRING deg." in the PARA DATA bending beam window. → all angles change! • SINGLE ANGLE CORRECTION CORR for certain program lines. → individual angles change! • ANGLE CORRECTION CORR for all bending angles. → all angles change!	6.8.3 7.1 7.1
• Optimise backstop positions after measuring the parts	The "Line-related backstop correction" function supports you in making dimension corrections.	7.4
• Enter info texts and text modules	15 definable text modules facilitate input.	5.4
• Values deleted by mistake!	Use the UNDO key to restore the value immediately.	5.1.5
• Avoid writing similar programs from scratch.	Bending programs created as variable programs adapt automatically.	10.

Notes:

6.11. Example of input

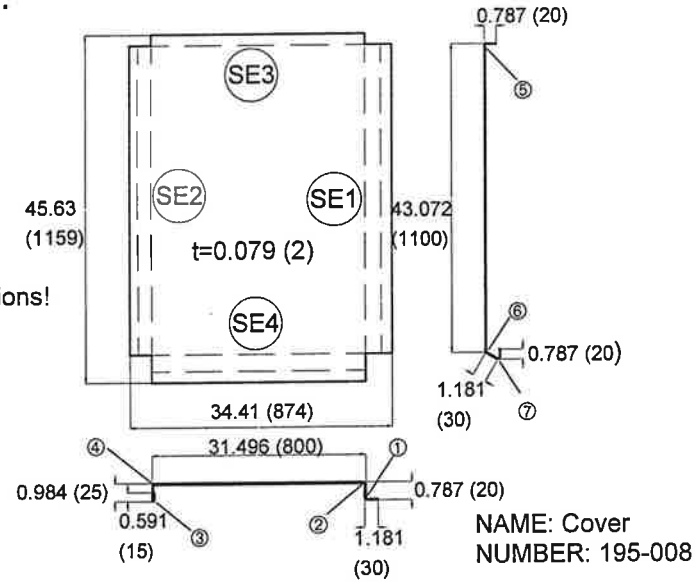
The following sample program illustrates how you can easily write a bending program.

Complete these steps in the following order:

1) Prepare the drawing.
   - Mark the bending sides and bending sequence.
2) Enter the bending program with info lines.
3) Enter the information text and text modules for the individual program lines.
4) Enter the program information.

1) Preparing the drawing:

All dimensions are outside dimensions!



2) Entering the bending program:

LINE							
1		34.409 (874,00)					
2	90,0	33.701 (856,00)		1.969 (50,00)	0.094 (2,40)	0.094 (2,40)	G
3	90,0	32.677 (830,00)		1.575 (40,00)			
4		32.765 (832,00)					
5	130,0	32.244 (819,00)		1.575 (40,00)			D F
6		33.465 (850,00)	0.157 (4,00)				C H
7	90,0	31.417 (798,00)		1.969 (50,00)			
8		45.630 (1159,00)					
9	90,0	44.921 (1141,00)		1.575 (40,00)			F
10		45.000 (1143,00)					
11	120,0	44.291 (1125,00)					DF
12	60,0	43.228 (1098,00)		2.362 (60,00)			

3)Entering the info text:

LINE	Info text	Angle corr. All	Single
1	DEVELOPED WIDTH		
2	LONG SIDE 1 LEG (1)	1.2	0
3	LONG SIDE 1 LEG (2)	1.2	0
4	REST DEV. AFTER TURN		
5	PRE-FOLD BEAD (3)	1.2	0
6	CLOSE BEAD (3)		
7	LONG SIDE 2 LEG (4)	1.2	0
8	DEVELOPED LENGTH		
9	FACE END 1 LEG (5)	1.2	0.5
10	REST DEV. AFTER TURN		
11	FACE END 2 LEG (6)	1.2	0.5
12	FACE END 2 LEG (7)	1.2	0.5

4)Entering program information:

```
PROGRAM INFO
NUMBER   :  195-888
NAME     :  COVER
COMMENT  :
PCS.     :    50
FINISHED :  940225    (yymmdd)
STATUS   :    3

T * W * L: 0.079 * 34.409 * 45.630
STRENGTH :   50      ksi
MATERIAL :
INFO     :
```

Notes:

7. Program corrections

The bending results of your finished parts depends on many influencing factors.

- Different materials have different spring-back properties, as do identical materials from different batches or delivery lots.
- Different bending radii change the side lengths. When you enter the backstop positions you have already accounted for these deductions.

This means: Although you have utilised all arithmetic calculation options during the creation of the bending program, you may still have to make some corrections to the bending angles and backstop positions to achieve optimal results.

You have gained important experience by learning to deal with all of these influencing factors. We want you to make the best possible use of this experience while you work with the machine. The Multibend controller therefore has a number of functions to help you make corrections to the bending angles and backstop positions.

Notes:

7.1. Angle corrections

When you entered the program you always specified the bending setpoint in the  column, without accounting for the spring-back properties of the material.

Example:

Setpoint input		
90.0°	not	91.5°
45.0°	not	46.8°

These inputs mean your bending program always matches the drawing exactly and is easy to read and understand.

The spring of the material is practically independent of the bending angle, and is described as the "spring constant". The controller provides two ways of compensating for this spring-back:

1) Correct all bending angles in the program.

2) Make additional precision corrections to individual bending angles for short or long bending edges (see 7.2 Line-related angle corrections).

Correcting all the bending angles in the program:

Exercise:

You have folded a plate at 90° on all four sides. When you measure the angles you find that all angles are only 88.5°.

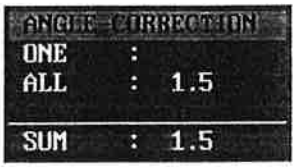
Proceed as follows:

Stop program execution by pressing the 

key and use the cursor keys to move the cursor into the  bending angle input column.

Use the 

soft key function to open the input window for bending angle correction.



Use the ↑ ↓ cursor keys to move the cursor to the "ALL" line.

On the 10-key pad, enter the correction value for the angle. In our example, 1.5°.

You can clear existing values with the CL key.

Check the value in the "SINGLE" line. Always correct all bending angles before you change specific individual angles (see 7.2 Line-related angle corrections).

Exit the level with the EXIT soft key function or the key.

The controller now uses the specified spring constant for all bending angles in the program. Above the soft key bar you can see the total bending angle for the current program line.

Bending angle + spring constant

When you move the cursor up and down in the input column , you will see that the controller has added the correction factor to all of the bending angles.

IMPORTANT: The "ALL" angle correction and the "SHEET SPRING deg." parameter in the PARA DATA level always have the same value! You can enter the spring constant in the "BENDING BEAM" parameter window too (see also 6.9.2 Bending beam parameters).

When the program is saved to diskette (see 11.1.3 Saving and loading programs), the "ALL" angle correction is automatically saved with the program.

7.2. Line-related angle corrections

In most applications it will suffice to just correct all bending angles (spring constant) to achieve ideal bending results.

Line-related angle corrections are only needed for:

- small or large bending angles within the program.
- workpieces with big differences in the lengths of the ends and sides. Short edges require less bending angle.

You can enter a separate correction value for each bending angle in the program. When the program line is executed, the controller adds the "SINGLE" angle correction to the "ALL" correction angle to produce the final angle.

Exercise:

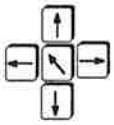
After you have entered the general angle correction (spring constant), you discover that the 2nd side is bent at too great an angle.

Setpoint bending angle:	90°
General angle correction:	1.5°
Effective bending angle:	91.5°
Actual angle of side 2:	90.4°
Required single correction:	0.4°

Proceed as follows:

We are in the program input level and have interrupted program execution with the 

key.

Use the cursor keys  to move the cursor onto the angle you want to correct.

Use the 

soft key function to open the input window.

When the input window opens, the cursor will be in the first line "SINGLE". Use the 10-key pad to enter the single correction factor (-0.4) for the bending angle.

You can delete false values with the CL key.

Note: To reduce the total bending angle (91.5°), you must specify the single correction as a negative value. To do this, first enter the absolute value, then press the key.

In the "TOTAL" line you can see the calculated total correction (-0.4 + 1.5 = 1.1°).

Exit the level with the soft key function or the key.

When you move the cursor up and down in the column you will see that the single correction applies only to one line of the program.
You can specify a correction value for each individual line of the bending program.

7.3. Program-related backstop corrections

A general correction to the backstop position in the bending program is only necessary if the bending line no longer aligns correctly to the front edge of the upper beam tool. This difference can be caused by tool wear.

Note: If the backstop position is wrong for all of your upper beam tools, you must correct the backstop calibration dimension in the Save parameter data.

Exercise:

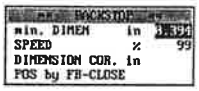
Due to material wear on the upper beam tool, the backstop position needs to be corrected by0.008 inch (0.2 mm).

Proceed as follows:

We are in the program input level.

Choose the PARA DATA soft key function to go to parameter input.

Use the NEXT MENU soft key to advance to the "BACKSTOP" input window.



Use the ↑ ↓ cursor keys to move the cursor to the "DIM. CORR." input line and enter the correction value (e.g. 0.008 (0.2)).

Exit the input window with the EXIT soft key or the key.

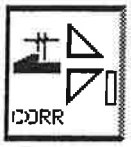
The backstop positions in the individual program lines have not changed. In the current program line you can see the modified backstop position:

Backstop position + general backstop correction

When you move the cursor up and down in the program line you will see that the backstop correction has been applied to all backstop positions.

Notes:

7.4. Line-related backstop corrections



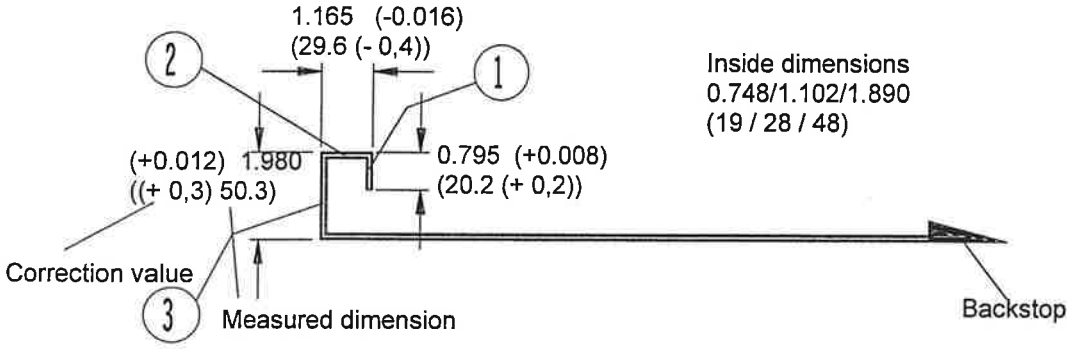
Different spring-back properties of different materials affect not only the bending angle, but also the bending radii and thus the side lengths.
For this reason the measured side lengths may deviate from the specified values.

When you correct the backstop position for the side length you will find that the error in the backstop position moves on to the next side.
If the dimensions of the sides vary positively and negatively, correcting them can get very troublesome.

For this reason the Multibend 9000 controller provides a powerful correction function.

Exercise:

After bending a part you have the following results:



The bending program had the following backstop positions in our example:

LINE			Text information
1		12.598 (320,00)	INFO LINE PLATE WIDTH
2	90,0	11.850 (301,00)	SIDE 1 LEG 1
3	90,0	10.748 (273,00)	SIDE 2 LEG 1
4	90,0	8.858 (225,00)	SIDE 3 LEG 1

The backstop dimension was found using the function (see 6.2.1 Converting side lengths to the backstop position).

Problems involved:

For the first side (1) to become 0.008 inch (0.2 mm) shorter, the backstop setting must be increased from 11.85 to 11.858 (301.00 to 301.20).
When you calculate the correction value for the second side (2), you must account for the correction value of the first side (1).
I.e., the correction value is -0.016 + 0.008 = -0.008 (-0.4 + 0.2 = -0.2).
You would have to do the same calculation for all other correction values.

The CORR function of the Multibend controller does this calculation work for you.

Requirements:

- First provide the backstop correction (0.008) ((0.2)) for the first side (1).
- All other backstop positions in this bending sequence (2) (3) must be corrected using the correction value of the first side.
- The backstop position of the second side (2) then has to be corrected (-0.016) ((-0.4)).
- All other backstop position in this bending sequence must be corrected using the correction value of the second side.

In our example, the backstop positions change as follows:

Correction sequence	Correction amount	Backstop positions of the sides		
		①	②	③
		11.85 (301,00)	10.748 (273,00)	8.858 (225,00)
1st correction for side ①	+0.008 (+0,2)	11.858 (301,20)	10.756 (273,20)	8.866 (225,20)
2nd correction for side ②	-0.016 (-0,4)		10.740 (272,80)	8.850 (224,80)
3rd correction for side ③	+0.012 (+0,3)			8.862 (225,10)
Result		11.858 (301,20)	10.740 (272,80)	8.862 (225,10)

Entered backstop positions

Proceed as follows:

We are in the program input level.

Move the cursor to the  column of the first line you want to correct. In our example this is line 2.

Choose the  soft key function to open the results window:

Enter the first correction value (0.008) ((0.2)) on the 10-key pad.

You can delete mistakes with the  key.

Press the  soft key. In the cursor field you will see the new backstop position.

As we saw in the **Requirements** section above, all subsequent backstop positions in this bending sequence must be changed by the correction amount applied to the first side.

Move the cursor to each subsequent backstop position in turn and choose the  soft key function to correct the backstop positions.

Exit the window with the  soft key function.

To **correct the second backstop position** you must enter the correction value of the second side (2).

Move the cursor to the backstop field of the second side (in our example line 3) and open the input window by pressing the  soft key.

Enter the next correction value (-0.016) ((-0.4)).

Correct the backstop position of the second side by pressing the  soft key.

Now correct all subsequent backstop positions in this bending sequence using the correction value of the second side.

Use the steps described above to correct the last backstop correction (0.012) ((0.3)) and then the last backstop position (in our example line 3).

You have now corrected all of the backstop positions in this bending sequence without additional calculations or complicated procedures.

Note: If you have workpieces with several sides to bend, you must complete the correction procedure for the backstop sequence of each individual side.

Once all backstop positions have been corrected as described above, our sample program contains the following values:

LINE		
1		12.598 (320,00)
2	90,0	11.858 (301,20)
3	90,0	10.740 (273,80)
4	90,0	8.862 (225,10)

8. Running programs

To run a bending program, use the PROG EDIT soft key to go from the main menu to the programming and execution level.

If you are working with variable programs, please also read section 10.8 Running variable programs.

8.1. Important information before running the program

IMPORTANT: The machine must be operated by authorised, trained and instructed personnel only

Before you run the program, check the following settings:

BB-A

Has the bending beam adjustment been correctly programmed and set?

- Bending beam adjustment depends on plate thickness and radius (see 6.2.2 and 6.2.3).
- Has the bending beam been lowered? Check the scale values! (see 4.2 Calibration).

IMPORTANT: Check the bending beam adjustment when using split bending beam tools!

LB-A

Has the lower beam adjustment been correctly programmed and set?

- Lower beam adjustment depends on plate thickness and radius (see 6.2.2 and 6.2.3).
- Has the lower beam been lowered? Check the scale values! (see 4.2 Calibration).

Are you familiar with the "Lower backstop flaps" function? This function prevents the plate from being unexpectedly pushed towards the operator when the backstop is adjusted.
Has the auxiliary function been programmed correctly?
See also 6.6.5 Lower backstop flaps.

Have you checked the parameter data of the bending program and are they correct for your workpiece?
See 6.9 Parameter data.

Is the bending beam in its home position?
If not, please read the notes in sections 4.1 and 4.2.

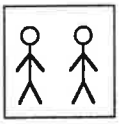
TOOL

Have you done a tool change?

IMPORTANT: As soon as you fit upper beam tools with a different height, you **must** re-calibrate the machine! See 4.2 Calibration.

Make sure the tools are correctly positioned.
Are all fixing screws tight on the bending tools?

Is the electromechanical safety facility on the built-in upper beam tool correctly set?
See 8.2 Setting the max. bending angle safety facility.



If two people are required for a work procedure, you must create the right conditions, i.e. it is **imperative to have a two-man system of operation.**
Machines without a two-man system of operation must be operated by one person only.
See section 7 of your "Mechanical" manual.

Never start a bending program unless all key lights on the operating panel of the controller are out.

Only the STOP and keys should be lit.

In general, do not do anything that could impair the safety of the machine.

For your own safety's sake, familiarise yourself with all applicable safety and accident prevention regulations. Please read the important information in section 2. Safety rules and section 2 of your "Mechanical" manual.

Notes:

8.2. Setting the max. bending angle safety facility

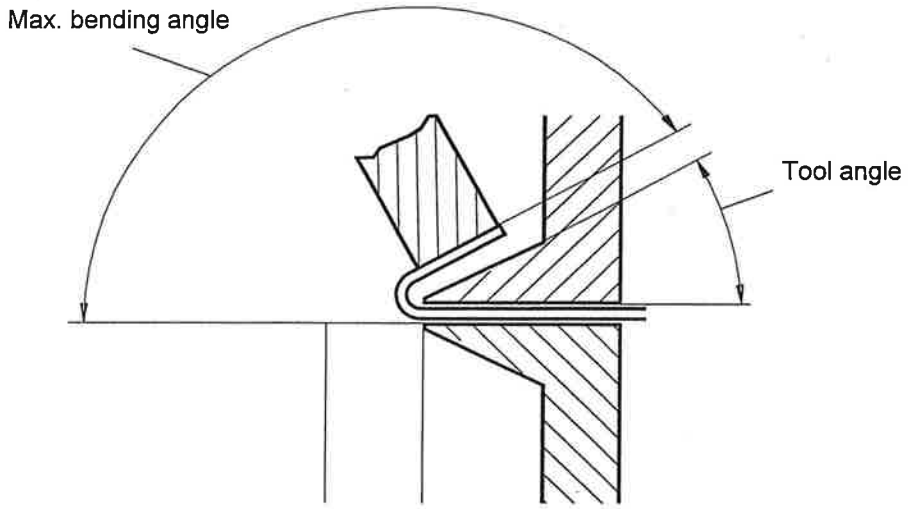
Each time you change the upper beam tool, you must adjust the mechanical safety facility to the maximum bending angle of the tools.
A wrongly set safety facility can cause considerable damage to the machine and tools.

Folding machines equipped with the Multibend 9000 controller have two limiting facilities:

1. **Limiting by parameters (see 6.9)**
   (electronic safety function)

2. **Limiting by mechanically operated switch**
   (electromechanical safety function)

The maximum bending angle is the distance the bending beam can move **without** the bending tools of the upper beam and bending beam colliding with each other.



Bending anglemax = 180° - tool angle

Example for adjustment

Upper beam tool shape	Max. bending angle
30° tool (split)	148°
45° tool	135°
20° tool	160°
Radius tool	180°

Observe bending radii!

Parameter limitation

In the input window for the bending beam parameters (see 6.9.2 Bending beam parameters) you must enter the maximum bending angle of the built-in upper beam tools.

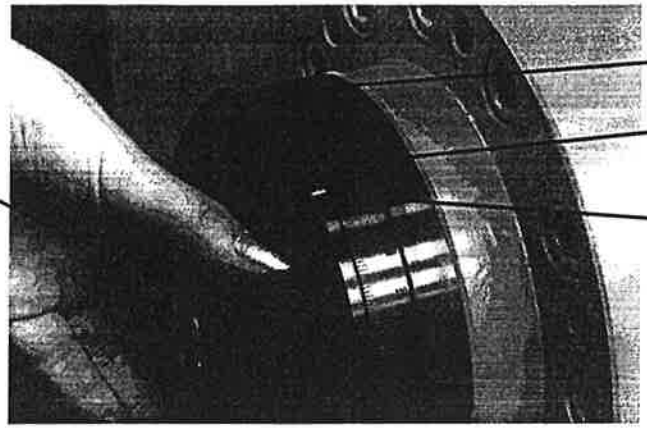
IMPORTANT: The parameter data are automatically saved with the bending program. When you load a new bending program, you **must** check the "max. BENDING ANGLE" value and correct it if necessary.

ATTENTION:
- The "max. BENDING ANGLE" value has an input limiting function. Values that are too high are not accepted by the controller.
- The setpoint angle is also protected by the software of the CNC controller when the program runs. Malfunctions that occur in the CNC controller are **not** detected.
- The electromechanical switch limitation must therefore be set in addition!

Switch limitation

On the left side of the machine, on the side column, is a hand-sized milled nut which is used to secure the scale disk.
If you loosen this nut by turning it anti-clockwise, the scale disk is released and you can set the maximum bending angle of the current tools.
The scale on the disk goes from 0-180°. A switching cam on the scale disk acts directly on a multi-position switch which interrupts the upward movement of the bending beam when the maximum bending angle is exceeded. A signal is also sent to a CNC controller input, and the electronics start the return movement of the bending beam.

IMPORTANT: After making an adjustment, **do not forget** to tighten the milled nut on the scale disk again (by turning it clockwise).



Please remember that when the upper beam tool is changed, the upper beam must be re-calibrated if the height of the new tool is different (see 4.2 Calibration). Example: changing from pointed tools to retaining clamp tools.

Notes:

8.3. User guidance

The Multibend controller frequently displays instructions and user information in the green bar at the top of the screen.
You can see which start command the CNC controller is waiting for. It also describes all machine movements that are started.
This gives the user important guidance while working with the machine and running programs.

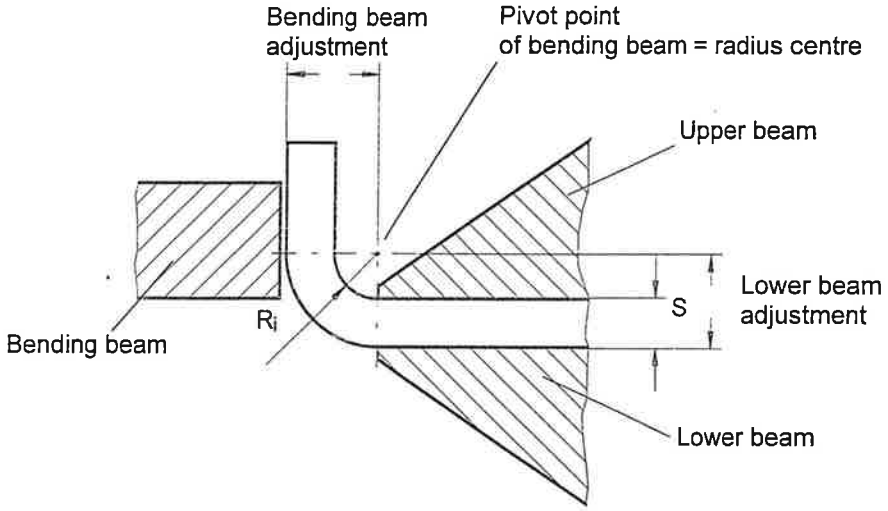
The following table explains the user guidance messages.

Instructions	Meaning
PROGRAM INPUT	The machine has not yet been started with "Start" or "Auto". The "Stop" lamp is still on.
VARIABLE PROGRAM	Your program is defined as a variable program.
BACKSTOP RUNNING	The backstop is moving into position and has not yet reached it.
BENDING BEAM ADJUSTMENT RUNNING	The stroke axis of the bending beam is moving to its next position.
LOWER BEAM ADJUSTMENT RUNNING	The lower beam is moving into its next position.
UPPER BEAM?	The machine has completed all axis adjustments and is waiting for the foot switch command to close or open the upper beam.
UPPER BEAM ↑	Upper beam is moving up.
UPPER BEAM ↓	Upper beam is moving down.
UPPER BEAM CLAMPED / BT?	The upper beam has clamped and the machine is waiting for the foot switch command to start the bending beam.
UPPER BEAM TILT	The two upper beam displacement measuring systems have detected an excessive difference, i.e. the upper beam is tilted. Open the upper beam again and, if necessary, program a target position for the movement.
BENDING BEAM?	The bending beam movement has been interrupted with the "Halt" foot switch. The controller is waiting for the next command (see section 8.8).
BENDING BEAM ↑	Bending beam is moving up.
BENDING BEAM ↓	Bending beam is moving down.

Notes:

8.4. Bending and lower beam adjustment

To achieve good bending results, the bending beam and lower beam must be set relative to each other in such a way that the pivot point of the bending beam is in the centre of the radius of the side.



Application in the program:

You have determined the adjustment distances of the bending beam and lower beam with the functions:

S factor (see 6.2.2 Calculating the bending and lower beam adjustment)

or

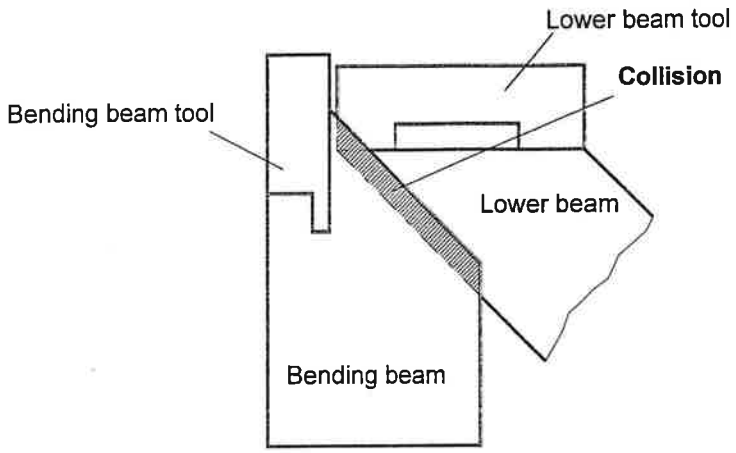
Math (see 6.2.3 Radius-related calculation of the bending and lower beam adjustment).

When the program runs, the bending beam and lower beam are automatically positioned to the entered value.
In program lines without bending beam and lower beam adjustment entries, the two beams remain in their old positions.

Notes: If you want to run individual program lines, you should always specify bending beam and lower beam adjustments.

The controller uses the entered bending beam and lower beam adjustment values to determine whether the bending beam and lower beam can collide.
If it decides there is a potential collision, you will not be able to run the bending program!

Check and correct the values for bending beam and lower beam adjustment.



However, this collision check is only done for the standard bending tools. If you are using higher tools (e.g. split bending tools), you must determine the correct adjustment values using the mathematic calculation aids (see sections 6.2.2 and 6.2.3).

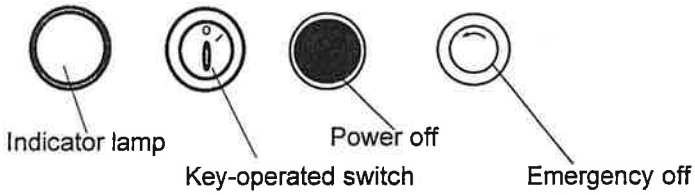
8.5. Running a single program line

The START key runs a single program line of the bending program. A bending program can consist of just a single line.

Proceed as follows:

Move the cursor to the program line you want to run. The cursor position within the line is irrelevant.

To run the program line, switch the machine power on using the key-operated switch on the operating panel.



If the white indicator lamp is lit, the power is on.

Run the program line by pressing the START key. The key remains lit. The executed program line appears on the screen with a white background.

Note: If the program line will not run:

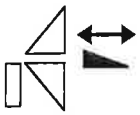
- it is an empty line.
- or the line contains an illogical (false) input.

ATTENTION: Do not press the START key if the bending beam has a support under it, as it would after having been serviced.
See also 4.1 Notes on commissioning and service work.

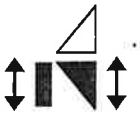
The following procedures are now performed in succession:

1. 

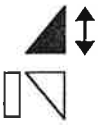
The bending beam automatically moves down if the "Bending beam down" limit switch has not yet been actuated.

2. 

The backstop moves to the specified position.
If you have not specified a backstop position, the backstop automatically moves to its maximum position and the flaps are lowered.
If the backstop is near the upper beam tools, the upper beam will automatically open to the height of the backstop flaps if this is necessary (see 8.7 Backstop logic).

3. 

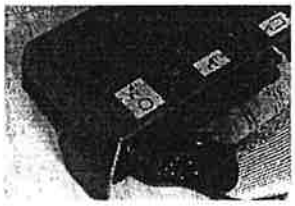
The bending beam and lower beam are adjusted to the values set in your program.
The controller checks for potential collisions between the two beams, and decides which order to make the adjustments in (exception: higher bending tools; see 6.2.2 and 6.2.3).

4. 

After displaying the user message:

"UPPER BEAM?"

you can clamp the plate with the "Close upper beam" foot switch.



The closing movement is completed in step mode, i.e. you must keep your foot on the foot switch until the beam has closed fully.
The closing procedure is complete when the user message:

"UPPER BEAM CLAMPED / BB?"

appears. If you press the left foot switch all the way down, the upper beam opens.

Note: Other instructions, or error messages such as

"UPPER BEAM TILT"

indicate that a false input has been made (see 6.3 Notes on upper beam input).

5. 

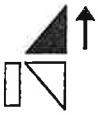
With the right foot switch, "Move bending beam", you start the bending beam. Just press the right foot switch briefly to do this.

The bending beam moves to the set angle position. It then moves back to the lower position.

IMPORTANT: If problematic situations occur unexpectedly during bending, you can interrupt the bending process with the right "Halt" foot switch. To do this, press the right foot switch all the way down (see 8.8 Interrupting the bending process).

Note: If long sides are moving up with the bending beam, it is advisable to select the 

"Reduced bending beam speed" auxiliary function in the relevant program line (see section 6.6.2).

6. 

As soon as the "Bending beam down" limit switch is reached, the upper beam opens automatically to the set value.
If you have not entered a dimension for the opening distance in the program line, the upper beam opens to the value of the "STROKE min." parameter (see 6.9.1 Upper beam parameters).

The bending process defined by the program line has been completed. The controller remains in START mode. You can repeat the program line any number of times.

If you run the individual program line with the START function, the piece counter has no function.

If you want to use the piece counter when running a single program line, you must use the INSERT soft key function to insert an empty line after the program line. Then move the cursor to the program line and run it using the AUTO function (see 8.6).

The STOP key stops execution of the program line and returns you to program input mode.

The ● key ("Power off") has the same function, but also switches off the hydraulic motor.

Notes:

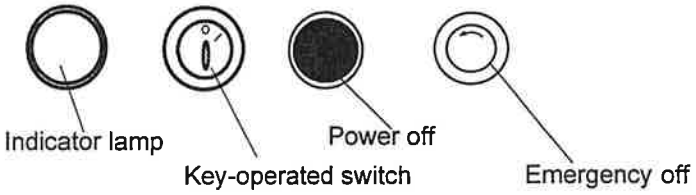
8.6. Running a multiple-line program

A multiple-line program can consist of anything between 1 and 39 program lines. The important thing is to include an empty line after the last program line, as the controller interprets this empty line as the end of the program.
The controller executes all program lines consecutively. When it encounters an empty line, the cursor automatically returns to the "starting line" of the program.

Proceed as follows:

Move the cursor to the first line (starting line) of the multiple-line program. The cursor position within the line is irrelevant.
If you want to use the piece counter to determine the number of finished parts, you must program it (see 6.7 Piece counter).

To run the program, switch the machine power on with the key-operated switch on the operating panel.



If the white indicator lamp is lit, the power is on.

Run the program line by pressing the AUTO key.

The START and AUTO keys remain lit. The first program line appears on the screen with a white background. The controller saves the line number of the starting line.

Note: If the program line will not run:

- it is an empty line.
- or the line contains an illogical (false) input.

ATTENTION: Do not press the AUTO key if the bending beam has a support under it, as it would after having been serviced.
See also 4.1 Notes on commissioning and service work.

The controller performs the individual programmed functions in the program line as described in section 8.5.
After completing the first program line, the cursor automatically moves to the next line, which in turn is executed.

Note: The currently active program line appears with a white background.

If the cursor encounters an empty line, the controller automatically returns to the starting line of the program. The piece counter adds (or subtracts) the number of finished parts.

When the piece count reaches zero, the controller automatically goes to STOP .

When the controller executes program lines it automatically ignores "Info lines" (see 6.5.2 Automatically displayed information).

You can abort the bending program in any program line using the STOP key.

The key, "Power off", has the same function but also switches off the hydraulic motor.

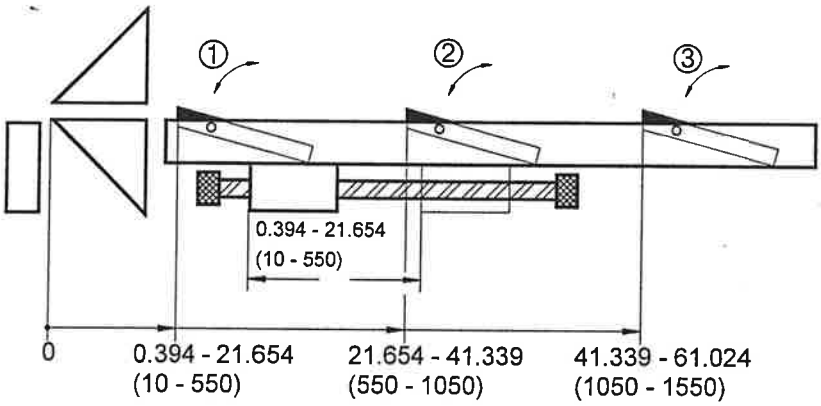
8.7. Backstop logic

The CNC controller has a number of automatic backstop logic functions:

- Control of the backstop flap rows.
- Detection of collisions between the backstops and the upper beam tool.
- Inactive backstop position when working from markings.

Control of the backstop flap rows

In the basic version, the backstop of the RAS folding machine with Multibend controller has 3 rows of flaps (up to 8 rows of flaps are optionally available).



Although the recirculating ball spindle of the backstop has an adjustment range of only 21.654 inch (550 mm), backstop positions of 0.394 - 61.024 inch (10-1550 mm) can be set by adding the appropriate rows of flaps.
(Optionally up to 80.709, 100.394, 120.079, 159.449 (2050, 2550, 3050, 4050) with 4, 5, 6, 8 rows of flaps).

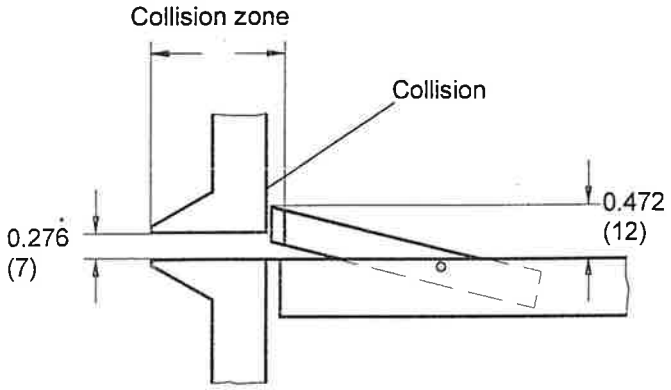
Advantages:

- Short backstop adjustment times. Large positioning dimensions are set using a short positioning distance and controlling the rows of flaps.
  The resulting maximum adjustment time is 3 seconds for 0.394 - 159.449 inch (10 - 4050 mm).
- Little space required. The length of the travelling unit and drive is integrated into the travelling distance. For a backstop with 61.024 inch (1550 mm) backstop depth, the space required is also only 61.024 inch (1550 mm).

The controller uses the specified backstop position to calculate the optimal flap row and calculates the associated differential travel distance of the backstop.
You need only enter the desired backstop position.

Collision detection

Depending on the machine type, the active backstop flap row projects beyond the backstop table by up to 0.472 inch (12 mm).
If you did not specify an opening height when you entered the program  , the upper beam will open 0.276 inch (7 mm) (for example).
If the backstop were to move to a backstop position inside the collision zone, it would collide with the upper beam.



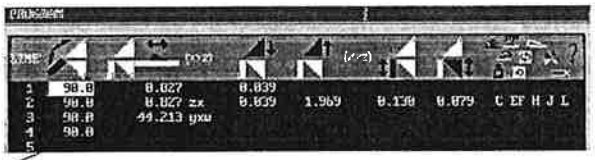
Before positioning the backstop, the CNC controller checks if the backstop position is inside the collision zone.
If it is, the upper beam is automatically opened far enough for the backstop to be positioned.
The size (6.89 inch) ((175 mm)) of the collision zone is specified in the Save parameters under "BACKSTOP".

Note: You specify the minimum opening height of the upper beam in the 

level. In the "UPPER BEAM" input window, specify the minimum opening height with the "STROKE min." parameter (6.9.1 Upper beam parameters).

Inactive position of the backstop for working from markings

If you enter a program line **without** a backstop position, the controller assumes you want to work from markings and do not need the backstop.



Working from markings!

When the program runs, the backstop moves to its maximum position and all backstop flap rows are lowered.

The current line shows the message **INACTIVE**. You now have a free work surface for working from markings.

8.8. Interrupting the bending process

The upward or downward movement of the bending beam can be interrupted if a dangerous situation arises.

The right "Move bending beam" foot switch has a second switch position called "Emergency halt". To stop the bending beam movement, press the left (right) foot switch all the way down.

Second switching

When you "Emergency halt" the bending beam, the machine is still under power. The bending beam goes into a control loop and the control hydraulics hold the beam in its current position.

Never undertake any service work or other work on the machine when the bending beam is in this position!

There is a distinction between:

- "Emergency halt" when the beam is moving upwards.
- "Emergency halt" when the beam is moving downwards.

"Emergency halt" when the beam is moving upwards:

If you pressed the "Emergency halt" foot switch during the upward movement of the bending beam, the following window will appear on the screen:

```
* FOLDING beam 'STOP' / adjustment *
- UP   : FOOT-SWITCH        F-beam
- DOWN : 'START' switch
- END  : 'STOP' switch
```

The following keys light up on the operating panel:

STOP + START After running a single program line.

STOP + START + AUTO After starting a multiple-line program.

The info text in the window tells you what to do next:

- If you want to **continue the upward movement of the beam**, you must press the "Move bending beam" right foot switch:

When you do this, the STOP lamp will go out.

- If you want to **move the bending beam down**, you must press the STOP key. The following window will then appear:

```
* FOLDING beam 'STOP' / adjustment *

- DOWN  : 'START' switch
- END   : 'STOP' switch
```

Now press the right "Move bending beam" foot switch to lower the bending beam. The STOP lamp will go out.

- To **abort the entire movement**, press the STOP key or the Emergency off switch

ATTENTION: After aborting the bending procedure, the bending beam will be in swung-out position without the influence of a control loop, which means it will slowly drop.

"Emergency halt" when the beam is moving downwards:

If you pressed the "Emergency halt" foot switch during the downward movement of the bending beam, the following window will appear on the screen:

```
* FOLDING beam 'STOP' / adjustment *

- DOWN  : 'START' switch
- END   : 'STOP' switch
```

The STOP lamp will light up in addition to the start command keys.

- If you want to **continue the downward movement of the beam**, you must press the "Move bending beam" right foot switch:

```
* FOLDING beam 'STOP' / adjustment *

- DOWN  : 'START' switch
- END   : 'STOP' switch
```

- To **abort the entire movement**, press the STOP key or the Emergency off switch

ATTENTION: After aborting the bending procedure, the bending beam will be in swung-out position without the influence of a control loop, which means it will slowly drop.

Notes:

8.9. Interrupting the program

You can interrupt the execution of a bending program at any time.
The best time to interrupt the program is before the bending beam starts to move.

There are two ways to quit the bending program:

Interrupt the program with the Stop key, as long as no danger is involved. The machine remains under power.

Not

Interrupt the program with the Emergency off key. Use this method if a dangerous situation arises!
Power is automatically cut off from the machine, and all machine movement immediately halts.

In both cases, the 

and 

start functions are cancelled and the 

key lights up.

You are then in the program input level.

Notes:

8.10. Bending beam step mode

If you are not quite sure whether the part you want to bend is actually feasible, it is a good idea to work in step mode the first time you run the program.

ATTENTION:
- Step mode only affects the upward movement of the bending beam.
- When the bending beam reaches the specified bending angle, it immediately moves down into its home position.

If you started the bending program with the START or AUTO key, you can activate or deactivate step mode at any time using the STEP key.

Step mode has the following properties:

- The bending beam only moves upwards if you have your foot on the "Move bending beam" foot switch. When you take your foot off the switch, the upward movement of the beam is immediately interrupted.
- When you work in step mode, the bending beam moves at a reduced speed (about 50%). This value is specified in the Save parameters.

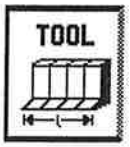
As soon as you release the "Move bending beam" foot switch, the following window appears on the screen:

```
* FOLDING beam 'STOP' / adjustment   *
- UP     : FOOT-SWITCH        F-beam
- DOWN   : 'START' switch
- END    : 'STOP' switch
```

Please refer to section 8.8, paragraph entitled "**Emergency halt when the beam is moving upwards**" for an explanation of these instructions.

Notes:

9. Tool management



9.1. Fundamentals

From the main menu, press the  soft key to go to the tool manager.

The tool management level  is where you define your tools for the upper beam, bending beam and lower beam.
When it calculates the tool setup (see 6.8 Tool positions (tool setup)), the CNC controller retrieves the data from the tool manager. This means the tool setup for the individual beams is calculated from existing sections.

Note: A list of the available tools at the time of shipping is provided as an appendix to the parameter lists. These pages are included with the acceptance certificate. Blank pages for tool management are provided at the end of this manual.

When you enter the level, the controller displays a tool set for the upper beam. The soft key for selecting the upper beam tools  is shown on a white background (reverse video).

The "Tool management" level is divided into three sections:

-  Tool sets for the upper beam (max. 15)
-  Tool sets for the bending beam (max. 10)
-  Tool sets for the lower beam (max. 5).

Use the  and  soft keys to browse through the tool sets.

Use the  cursor keys to move the cursor around in the tool set.

Use the  key to delete a false value.

A soft key "typewriter" is available for entering text. You can only activate the typewriter in input lines where the  soft key is visible.

For instructions on how to use the typewriter, please refer to section 5.3 Typewriter.

Use the  soft key to exit the level and return to the main menu.

Connections between the "Tool management" and "Tool positions" levels

When you define the tool setup (see 6.8 Tool positions), you must enter a tool set number in the "TYPE" column.

Example: Upper beam tool setup

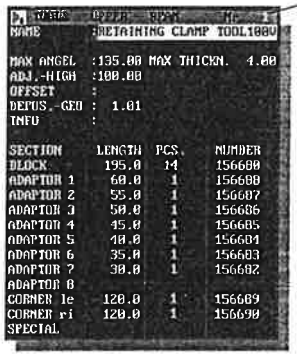
To calculate the required sections for the rail length of 59.005 inch (1500 mm), the controller retrieves the data from tool set number 1.

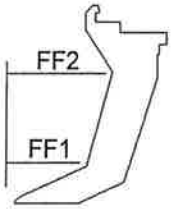
9.2. Definition of upper beam tool sets

There are 15 input windows for entering the various upper beam tool sets. For each tool set, the controller provides a graphical display of the geometric shape of the upper beam tools.

Choose the  soft key to go to the input level for upper beam tools.

Tool set number



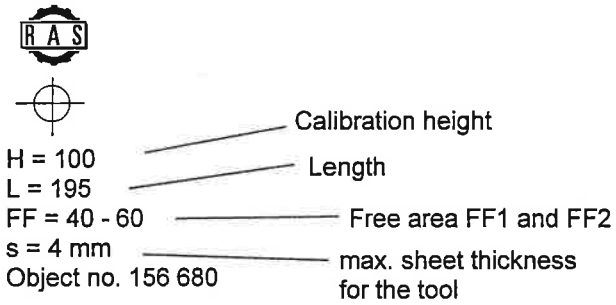


Explanation of the input lines:

NAME: The name of the tool set.

MAX ANGLE: The maximum bending angle for the upper beam tool. The maximum bending angle depends on the geometry of the tool.

MAX THICKNESS: The maximum sheet thickness that will be bent using the tool. The maximum sheet thickness depends on the geometry and height of the tool and is marked on the tool:



Please always observe the manufacturer's specifications for the

- MAX ANGLE and
- **MAX THICKNESS** when working with the individual tools!

If you do not proceed correctly, you are very likely to cause damage to the tools and machine!

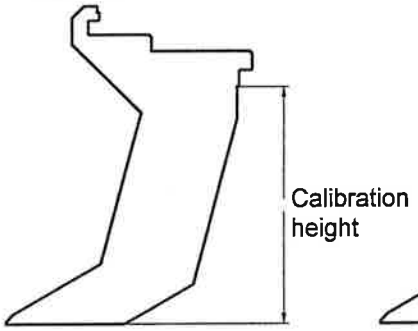
CAL HEIGHT: The calibration height is marked on each tool.

Example: RETAINING CLAMP TOOL 100 V = 3.937 inch (100 mm)

OFFSET: After regrinding your tools, enter the dimension difference in this line.

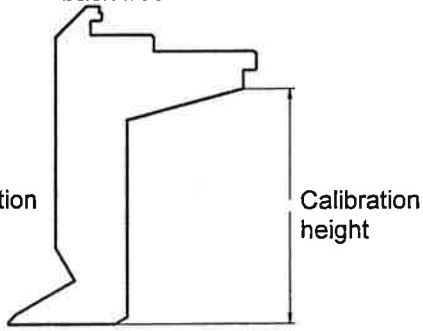
DEPOS. GEO: Enter the right ID number to activate the graphical display of your tool set.

Retaining clamp tool xxx V "front free"



DEPOS: GEO: 1.01

Retaining clamp tool xxx H "back free"



DEPOS: GEO: 2.01

Note: To display the graphics, exit the tool set and return immediately.

Do this using the  and  soft keys.

INFO: Space for entering information on the tool set.

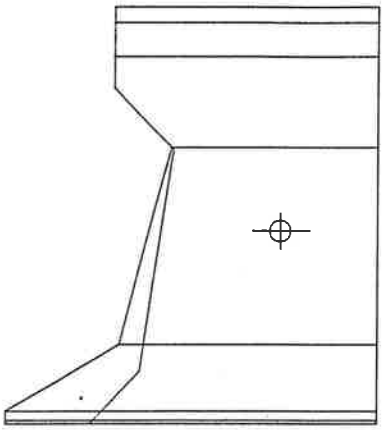
In the following input lines, enter the

- lengths,
- quantity, and
- object numbers of the individual tools of the tool set.

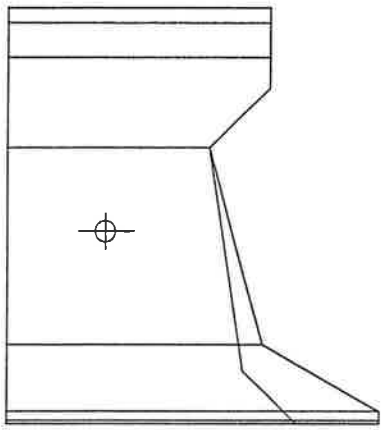
CORNER l:

CORNER r:

Corner left



Corner right



SPECIAL: If you have a special section in your tool set, enter its data in this line.

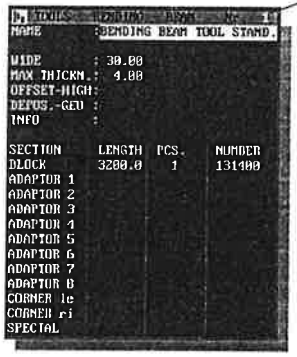
Notes:

9.3. Definition of bending beam tool sets

There are 10 input windows for entering the various bending beam tool sets.

Choose the  soft key to go to the input level for bending beam tools.

Tool set number



Explanation of the input lines:

NAME: The name of the tool set.

MAX THICKNESS: The maximum sheet thickness that will be bent using the tool. The maximum sheet thickness depends on the width of the tool.

Please always observe the manufacturer's specifications for the

- **MAX THICKNESS** when working with the individual tools!

If you do not proceed correctly, you are very likely to cause damage to the tools and machine!

OFFSET HEIGHT: After regrinding your tools, enter the height difference in this line.

DEPOS. GEO: Enter the right ID number to activate the graphical display of your tool set. In preparation!

INFO: Space for entering information on the tool set.

Example: 35MM BENDING BEAM HIGHER SPLIT TOOL

In the following input lines, enter the

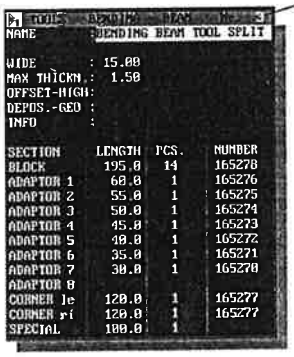
- lengths,
- quantity, and
- object numbers of the individual tools of the tool set.

Note: Input values for a continuous bending tool rail are shown in the screen above. For split bending beam tools, please follow the example below.

SPECIAL: · If you have a special section in your tool set, enter its data in this line.

Input example for a split bending beam tool:

Tool set number



NAME BENDING BEAM TOOL SPLIT

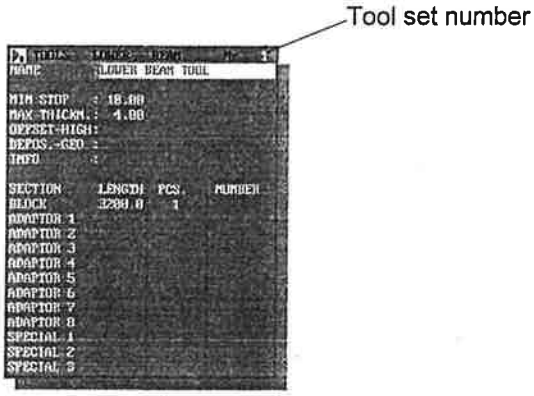
WIDE : 15.00
MAX THICKN.: 1.50
OFFSET-HIGH:
DEPOS.-GEO :
INFO :

SECTION	LENGTH	PCS.	NUMBER
BLOCK	195.0	14	165278
ADAPTOR 1	60.0	1	165276
ADAPTOR 2	55.0	1	165275
ADAPTOR 3	50.0	1	165274
ADAPTOR 4	45.0	1	165273
ADAPTOR 5	40.0	1	165272
ADAPTOR 6	35.0	1	165271
ADAPTOR 7	30.0	1	165270
ADAPTOR 8			
CORNER le	120.0	1	165277
CORNER ri	120.0	1	165277
SPECIAL	100.0	1	

9.4. Definition of lower beam tool sets

There are 5 input windows for entering the various lower beam tool sets.

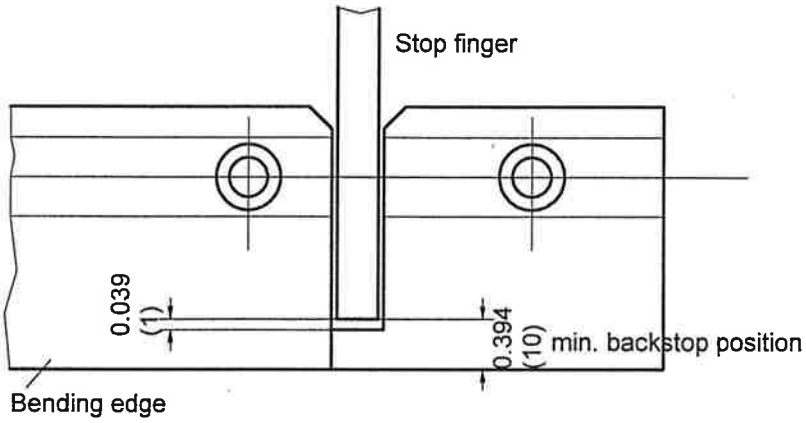
Choose the  soft key to go to the input level for lower beam tools.



Explanation of the input lines:

NAME: The name of the tool set.

MIN STOP: Enter the smallest possible backstop position for the lower beam rail.



MAX THICKNESS: Enter the maximum sheet thickness for the lower beam tool.

Please always observe the manufacturer's specifications for the

- MAX THICKNESS when working with the individual tools!

If you do not proceed correctly, you are very likely to cause damage to the tools and machine!

OFFSET HEIGHT: After regrinding your tools, enter the height difference in this line.

DEPOS. GEO: Enter the ID number to activate the graphical display of your tool set. In preparation!

INFO: Space for entering information on the tool set.

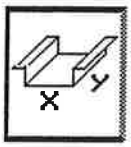
In the following input lines, enter the

- lengths,
- quantity, and
- object numbers of the individual tools of the tool set.

Note: Input values for a continuous lower tool rail are shown in the screen above.

SPECIAL: If you have a special section in your tool set, enter its data in this line.

10. Variable programs



10.1. Fundamentals

Are you fabricating similar parts with varying dimensions?
If so, you should read this chapter carefully.

The purpose of a variable program is to:

- automatically convert backstop positions in bending programs using variables so that you need only one bending program for a complete family of parts.
- calculate the developed lengths and widths of sheets depending on variables.
- re-determine the notching dimensions of the plate using variable values.

Applications for variable programs:

All fabricated parts in which the sheet thickness and bending sequence are identical, but which have constantly changing dimensions and side heights.

Typical parts produced with variable programs include:

- shelves
- case-bays
- metal doors
- facade elements
- window cornices

.

.

You only need one bending program for all dimensions of the part. When a new dimension is required, the controller automatically calculates the new backstop position and the modified plate cut.
The reduction in programming work means a high degree of flexibility without losing productivity.

IMPORTANT:
- You can make any "normal" program into a variable program.
- When you write a variable program, you **must** follow the input sequence described in section 10.2.

As many as 4 different dimensions of the part can be programmed as variables.
The variables are denoted by W, X, Y and Z. You assign these variables to the backstop positions of your basic program (see 10.5 Variable assignment).
Six variables (U, V, W, X, Y, Z) are in preparation!

The variables are given names. You also assign to the variables the dimensions at the time the program is written.

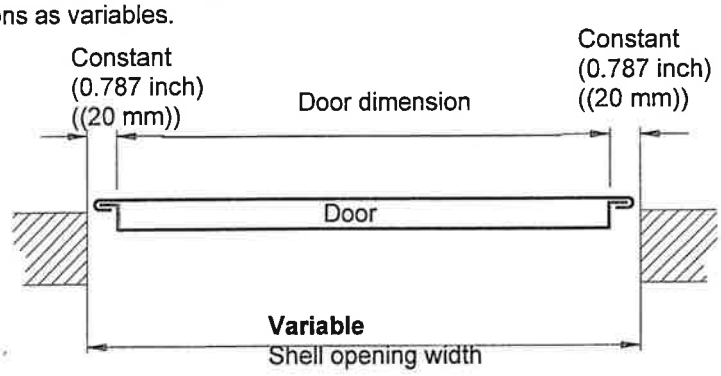
Variable	Value	Name
X	19.685 (500.00)	BAY WIDTH
Y	39.37 (1000.00)	BAY LENGTH
Z	1.969 (50.00)	BAY HEIGHT

When you run the variable program, you enter the new dimensions and side heights in the "Value" column.

Further variable programming options:

The variables can also be GRID DIMENSIONS, formed from the section dimensions and the constant dimensions.

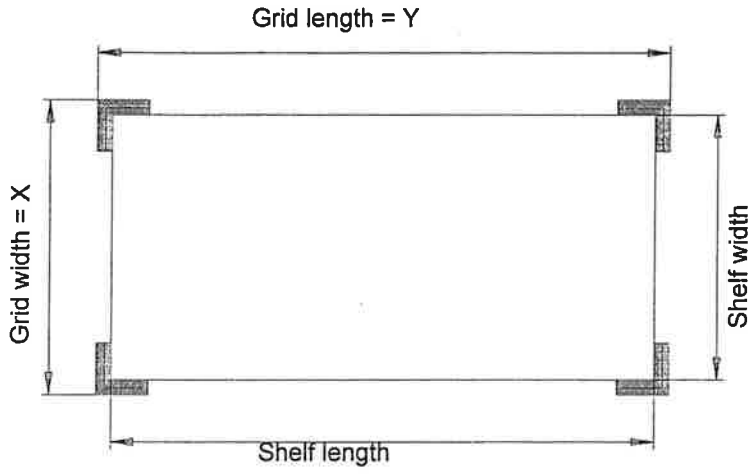
Example: For doors, instead of the door dimensions you can use the shell opening dimensions as variables.



(drawn without door case)

When you enter the basic variables you account for the two constant dimensions (see 10.6 Basic variable input).

Another example: For a shelf, you can enter the grid dimension (shelf length + post width) of the shelving.



Notes:

10.2. Input sequence

IMPORTANT: Always keep to the following input sequence when creating a variable program.

1. Create the basic program

The "basic program" is the basis for a variable program. You create a "normal" bending program for your workpiece, by simply taking a part from the group of parts. The finished part dimensions assigned to the variables can be different from the drawing dimensions; the important thing is that a given variable has the same value in each case.
And the notching on the folded part must already exactly match the variable dimensions (see 10.3 Basic program input).

2. Name the variables

In this level you decide which variables you need and assign names to them.

Example:

X = BAY WIDTH

Y = BAY LENGTH

Z = BAY HEIGHT

There are 4 variables available (W X Y Z), with a further two in preparation.

3. Assign variables to the program

Assign the variables to the backstop positions of your basic program. The important thing here is to account for all variables between the bending edge and the backstop position (see 10.5 Variable assignment).

4. Enter the basic variables

You have created the basic program for a real workpiece. If you bend and then measure this part, you will have the effective "actual" dimensions. There dimensions, referred to your variables, are the basic variables. They will not necessarily be the same as the desired dimensions (see 10.6 Basic variable input).

Once you have created the variable program, you must enter the "new" variable values and convert the backstop position to its modified dimensions (see 10.6 Basic variable input).

To run the variable program, please read section 10.8 Running variable programs.

Note: To facilitate management of your programs on diskette, you should enter a comment in the program information .

For example:

```
** PROGRAM - INFO **
NUMBER   :  CASE 143-753
NAME     :  VARIABLE
```

In the diskette manager you will recognise the variable programs by their names and numbers.

10.3. Basic program input with variable declaration

PROG EDIT

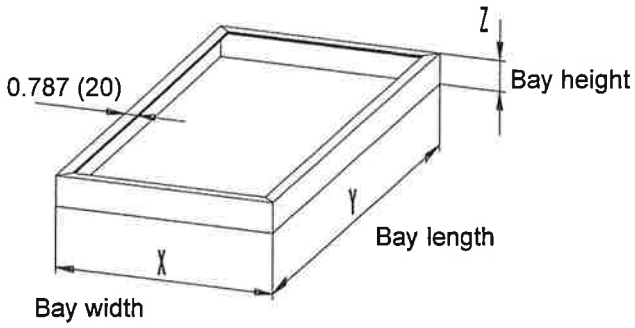
- Create a normal bending program for one of the parts from the group. If possible, choose a part with even-numbered dimensions for the variable side heights. This will make it easier to enter the program and the basic variables.
- Use the first 4 program lines as info lines, and enter the dimensions of your flat plate. Then copy the appropriate text modules (line-related information) to the program lines (see also 5.4 Text modules).
- Create the program information and write "VARIABLE PROGRAM" at the name or number.

```
NUMBER    :  CASE 143-753
NAME      :  VARIABLE

PCS.      :
FINISHED  :  94041     (yymmdd)
STATUS    :    3

T * W * L: 0.039 * 24.882 * 44.567
STRENGTH :   58       ksi
MATERIAL :
INFO     :
```

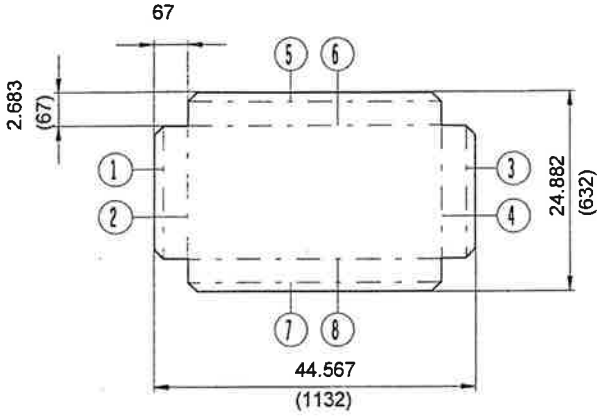
Example: case-bay



- The outside dimensions for the actual workpiece are as follows:

X =	19.685 inch (500 mm)	BAY WIDTH
Y =	39.37 inch (1000.00 mm)	BAY LENGTH
Z =	1.969 inch (50.00 mm)	BAY HEIGHT

- These dimensions produce the following plate dimensions:



- We now have the following values in the first four program lines (info lines):

LINE			Line info
1		24.882 (632.0)	PLATE WIDTH
2		44.567 (1132.0)	PLATE LENGTH
3		2.638 (67.0)	NOTCHING WIDTH
4		2.638 (67.0)	NOTCHING LENGTH

The whole basic program looks like this:

PROGRAM LINE							
1		24.882 (632,00)					
2		44.567 (1132,00)					
3		2.638 (67,00)					
4		2.638 (67,00)					
5	90,0	4.449 (113,00)	0.039 (1,0)		0.047 (1,2)	0.047 (1,2)	
6	90,0	41.93 (1065,00)	0.038 (1,0)				F
7		41.969 (1066,00)					
8	90,0	41.221 (1047,00)	0.039 (1,0)				
9	90,0	39.331 (999,00)	0.039 (1,0)	1.362 (60,0)			
10	90,0	24.134 (613,00)	0.039 (1,0)				F
11	90,0	22.244 (565,00)	0.039 (1,0)	1.362 (60,0)			
12		22.283 (566,00)					F
13	90,0	21.535 (547,00)	0.039 (1,0)				
14	90,0	19.646 (499,00)	0.039 (1,0)	1.362 (60,0)			

Note: Program line 7 is just an info line.
Why?

- After completing program line 6, the first face end is folded and completed.
- Turn the plate 180° to fold the second end.
- The plate is stopped on the outside edge of the previously folded side.

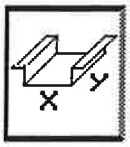
→ **Take account of the material thickness!**

- After folding the part, we have the following dimensions:

	TARGET	ACTUAL
X =	19.685 (500.00)	19.724 (501.00)
Y =	39.37 (1000..00)	39.437 (1001.70)
Z =	1.969 (50.00)	2 (50.80)

Write down the dimensions for entering the basic variables

10.4. Variable declaration



From the program level, choose the  soft key to go to the "VARIABLE ASSIGNMENT" level.

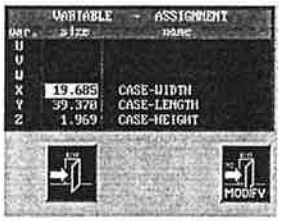
Use the  cursor key to move the cursor into the right column, "Name".

Use the soft key typewriter to enter the name of the variable. For an explanation of how to use the typewriter, see 5.3 Typewriter.

Enter a name for each required variable.

Assign the target dimensions to the variables.

The input window for our example looks like this:



Exit the level with the  soft key.

Notes:

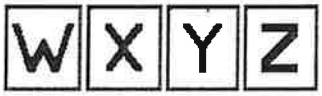
10.5. Variable assignment

You must add the declared variables (W X Y Z) to the backstop positions of the basic program.

Move the cursor into the  column in the program input level.

Change to variable assignment with the  soft key.

The controller opens the "VARIABLE ASSIGNMENT" window to provide information. The variables appear as soft keys in the soft key bar at the bottom of the screen.

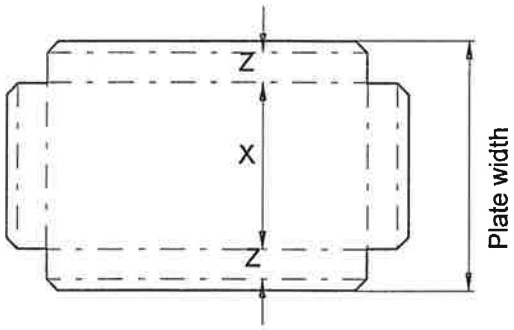


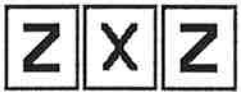
Use the  keys to move the cursor around in the "Backstop position" input column.

Variable assignment with our CASE BAY example

LINE 1:

The cursor is in the first program line, in the Backstop position column. If we picture our developed plate, in the plate width we have:
one VARIABLE X = BAY WIDTH and
two VARIABLE Z = BAY HEIGHT.



Assign the variable to the "plate width" dimension. Press the 

soft keys one after the other. In the Backstop position column we now have:

24.882 ZXZ (632.00 ZXZ)

LINE 2:

Move the cursor to the next line and assign the appropriate variable to the PLATE LENGTH. In the PLATE LENGTH we have:
one BAY LENGTH Y and
two BAY HEIGHT Z.

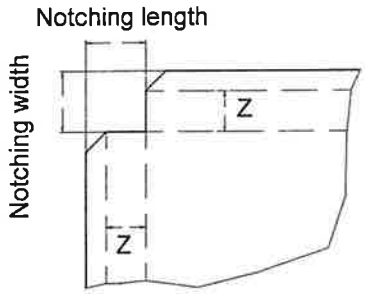
44.567 ZYZ (1132.00 ZYZ)

Note:

- You can delete false inputs with the CL key.
- You can assign up to 4 variables for each backstop position.

LINE 3 + 4:

In our example, the BAY HEIGHT is variable (Z) within the NOTCHING LENGTH.

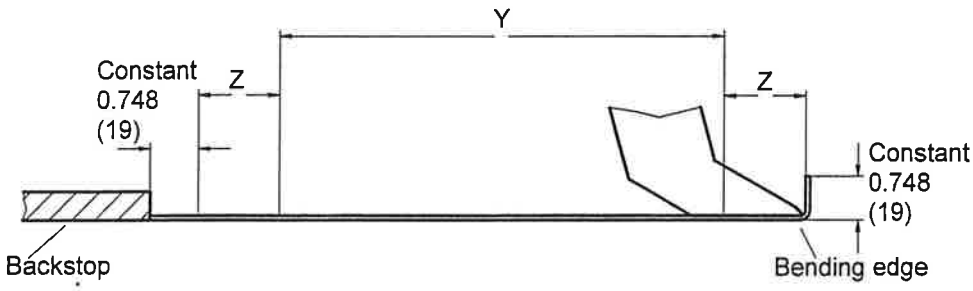


Use the Z soft key function to assign the Z variable to the two backstop positions for the NOTCHING LENGTH and NOTCHING WIDTH.

3 2.638 (67.00) Z
4 2.638 (67.00) Z

LINE 5:

For the first bend on the face end, we first bend the constant 0.748 inch (19 mm) dimension (outside dimension 0.787 inch (20 mm)). Between the backstop and the bending edge we still have:
one Y = BAY LENGTH and
two Z = BAY HEIGHT.

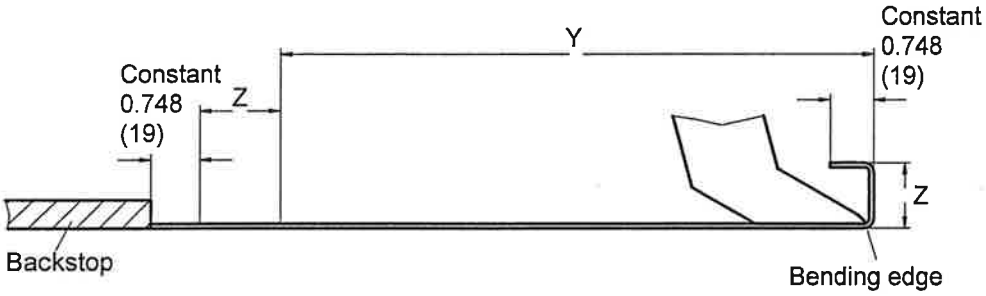


Add the Z Y Z variables to the backstop position.

44.488 ZYZ (1130.00 ZYZ)

LINE 6:

With the backstop position in line 6, the first variable side is "bent away". The backstop position is assigned only the variable between the backstop and the bending edge.



As you can see, we now have only:
one Z = BAY HEIGHT and
one Y = BAY LENGTH
between the backstop and the bending edge.

So, add the Z Y variables to the backstop position:

41.929 ZY (1065.00 ZY)

Enter the appropriate variable for each backstop position.
The result is the following backstop positions and variables:

LINE			LINE INFO
1	24.882 (632,00)	ZXZ	PLATE WIDTH
2	44.567 (1132,00)	ZYZ	PLATE LENGTH
3	2.638 (67,00)	Z	NOTCHING WIDTH
4	2.638 (67,00)	Z	NOTCHING LENGTH
5	43819 (1113,00)	ZYZ	1ST FACE END LEG 1
6	41.929 (1065,00)	ZY	1ST FACE END LEG 2
7	41.969 (1066,0)0	ZY	TURN PLATE + SHEET THICKN.
8	41.221 (1047,00)	ZY	2ND FACE END LEG 1
9	39.331 (999,00)	Y	2ND FACE END LEG 2
10	24.134 (613,00)	ZXZ	1ST LONG SIDE LEG 1
11	22.244 (565,00)	ZX	1ST LONG SIDE LEG 2
12	22.283 (566,00)	'ZX	TURN PLATE AND PLATE THICKN.
13	21.535 (547,00)	ZX	2ND LONG SIDE LEG 1
14	19.646 (499,00)	X	2ND LONG SIDE LEG 2

Exit the level with the  soft key function.

10.6. Basic variable input

From the program level, choose the  soft key function to go to the parameter input window.

Use the  soft key function to browse through until you see the following window:

After creating the basic program, we folded a part and made a note of the variable dimensions. From your notes, enter the actual dimensions of the folded part in this window.

IMPORTANT: In section 10.1 Fundamentals we provided two examples of variable programming with constant dimensions.
When you enter the basic variables, you must account for these constant dimensions.
Example: Door width: 31.496 inch (800 mm), measured 31.535 inch (801.0 mm)
Constant dim.: 2 x 0.787 inch (20 mm)
Input: 33.11 inch (841 mm)

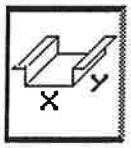
In our CASE-BAY example, we need not account for any constant dimensions, so we can enter the measured "ACTUAL" values directly.

Exit the parameter level with the  soft key.

Note: You have now entered the whole variable program. Remember to save the program to diskette (see 11.1.3 Saving and loading programs).

Notes:

10.7. Automatic program conversion



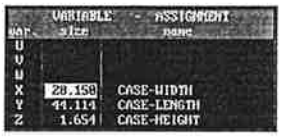
You have created a variable program for a part with constant dimensions. To produce a case-bay with different dimensions, the controller has to convert the backstop positions to the new variable dimensions.

Proceed as follows:

From the program input level, choose the  soft key function to go to the variable assignment level.

Dims:	Sample case-bay	New case-bay dimensions	
Width:	19.685 inch (500.0 mm)	Width:	28.15 inch (715.0 mm)
Length:	39.37 inch (1000.0 mm)	Length:	44.114 inch (1120.5 mm)
Height:	1.969 inch (50.0 mm)	Height:	1.654 inch (42.0 mm)

You can see that the "Value" column still contains the dimensions of the sample case-bay. Overtype the values with the dimensions of the new case-bay.
The following window is displayed on the screen:



Start the dimension conversion with the  soft key. This also exits the variable assignment level.

The controller is now in **Variable program** mode. This is indicated on the green bar at the top of the screen.

The cursor can no longer move in the  column because these values were not entered; they were calculated by the controller.

You can still change the entries in all other columns, e.g. for angle correction or for different opening heights of the upper beam.

There are two ways to exit Variable program mode:

1) Use the  soft key to go to variable assignment, and exit the level with the  soft key function.

2) Exit the program input level with the  key.

In both cases, the backstop dimensions of your basic program will appear again. You can now enter new variable values for a case-bay with new dimensions.

The controller calculates the new backstop positions using this equation:

Backstop pos.$_{new}$ = basic variables - variable assignment + new variable

VARIABLE PROGRAM

10.8. Running variable programs

- Load your variable program from the diskette. Remember you called it "VARIABLE PROGRAM" (see also 11.1.3 Saving and loading programs).
- Choose the PROG EDIT soft key function to go to the program input level.
- Choose the soft key to activate variable assignment. In the "Values" column, enter the new variable values of your drawing.
- Exit the level with the EXIT MODIFY soft key. The backstop positions are converted **automatically**. The controller is now in Variable program mode.
- If necessary, specify a piece count (see 6.7 Piece counter).
- Run the program with the AUTO key. If the cursor is in the first line, the controller will execute the whole variable program (see also 8.6 Running a multiple-line program).

Note: You can also run individual program lines at any time using the START key. The controller will then run just the line containing the cursor (see also 8.5 Running a single program line).

IMPORTANT: If you have made the height of a part variable in your variable program, you must check the input values for the opening height of the upper beam and correct them if necessary.
Also remember to account for the capabilities of your upper beam tools!

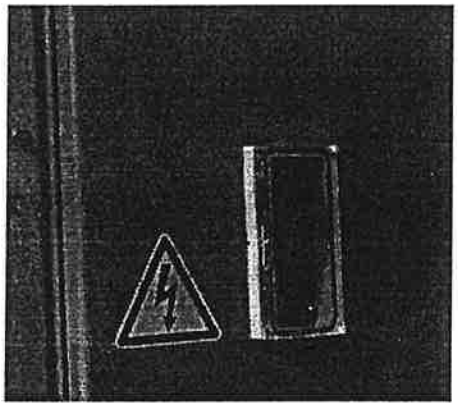
Notes:

11. Program management

11.1. Working with the diskette

11.1.1. About diskettes

The diskette drive is mounted on the front of the switch cabinet.

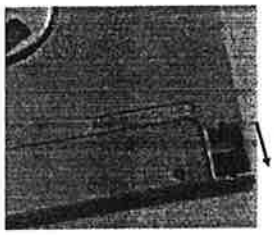


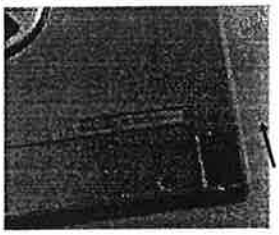
Diskette type

- The diskettes are the 3½" type.
- Use only diskettes labelled
  "3.5"-2DD"
  (double sided and double density)
- Brand products are best!

Write protection

Each diskette has a write protection tag. If you are just loading programs from the diskette, you should leave the diskette write protected. This will prevent programs (data) from being deleted accidentally.
The diskette is write protected when the lug is not covering the hole in the diskette.


Write protected


Write enabled

Formatting diskettes

The diskette format used by the Multibend controller is very different from that used by MS-DOS.

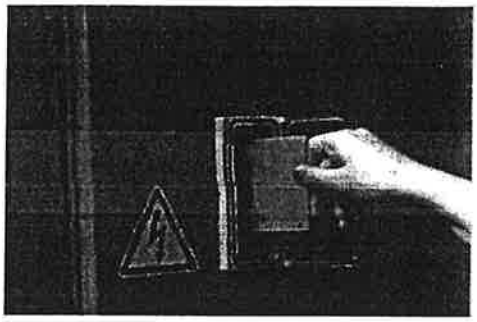
- The directory has a fixed number of 70 program files.
- The individual programs are stored on fixed sectors and tracks. The space reserved for a program is not variable in size. So, a program consisting of 3 lines uses just as much space as one with 40 lines.

IMPORTANT: You must always format the diskette using the controller. The controller **cannot** read diskettes formatted by MS-DOS.
The controller cannot write to unformatted diskettes. To format a diskette, see 11.1.6 Formatting (deleting) a diskette.

Inserting the diskette

Always insert the diskette in the drive in the direction indicated by the arrow.

The side with the arrow should be next to the lamp on the diskette drive.



Press the small, rectangular eject button to remove the diskette from the drive.

Protection and care

Always keep your diskettes in a closed box. Avoid the following harmful influences:

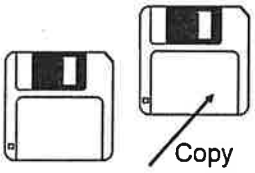
Never keep the diskette close to magnets or their fields!

Protect the diskette against moisture!

Avoid direct exposure to sunlight!
41 - 140°F (5 - 60°)

Protect against dirt and dust!

Note:



Make backup copies!

Copying diskettes

It is very important to make a backup copy of all of your program diskettes so that you do notlose your programs in the event that a diskette is damaged.
There are two ways to copy a diskette:

- Copy individual programs via the memory of the CNC controller.
- Copy an entire diskette using an MS-DOS personal computer.

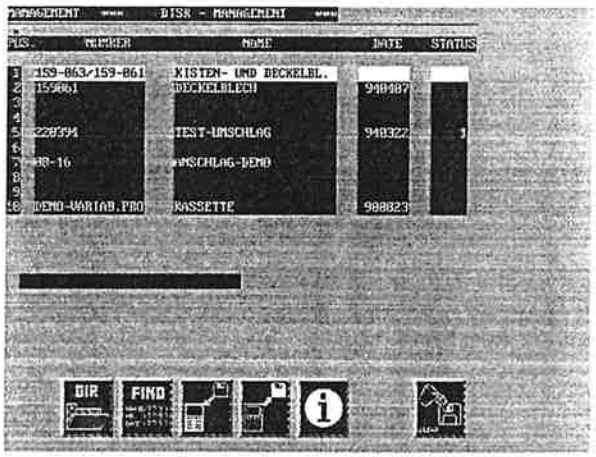
Single program: The best way to copy a single program via memory is to save the program to two different diskettes once you have written and optimised it. If you do not do this, you will have to read the program from the source diskette into memory, and then copy it back out to the destination diskette (your backup copy).

Entire diskette: The destination diskette (backup diskette) must first be formatted by the CNC controller! To copy an entire diskette, see 11.1.7 Copying a diskette using a PC.

11.1.2. Reading the diskette directory

After inserting the diskette in the drive, choose the  soft key function to go from the main menu to the diskette manager.

The CNC controller reads the diskette directory automatically as soon as you go to the diskette manager.

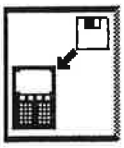


If you change the diskette while in the diskette manager, you can display the new directory by pressing the  key.

IMPORTANT: You must press the  soft key every time you change the diskette!

The  soft key appears in reverse video until the new directory has been read. Wait until the icon appears normally before taking any further actions.

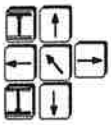
11.1.3. Saving and loading programs

Choose the  soft key to go from the main menu to the diskette manager. The controller automatically reads the directory of the inserted diskette.

Note: You can only save a bending program to a diskette if the diskette has first been formatted by the controller. See 11.1.6 Formatting (deleting) a diskette.

Before you save the program to diskette, you must give your bending program a name. Do this by choosing the  function in the program input level. Use the typewriter  to type the program name and number (see 6.4 Entering program information).

You can move the cursor up or down one line at a time with the  cursor keys.

You can save a complete bending program in each of the 70 lines. Each program consists of:

- the bending program (40 lines)
- program information
- parameters.

Saving programs

Move the cursor to an empty program slot and choose the  soft key function.

The following screen prompt appears:

CODE ? 

To prevent unauthorised people from overwriting your programs, we have provided an access code function.

Use the 10-key pad to enter your code number and confirm by pressing the  soft key again.

If you entered the correct code, the controller will save the program to the diskette. The 

soft key is shown in reverse video while the program is being written to the diskette. When the program has been saved, the PROG. NUMBER and PROG. NAME will appear on the current line.

If you enter an incorrect code number, the following message will appear:

```
- FALSCHER CODE !
```

In this case you must press the  soft key again and re-enter the code number.

If you type a wrong digit you can clear it during input using the CL key.

Note: The code number is included in the Save parameter list which is enclosed with the acceptance certificate. If you want to change the number, please contact the after-sales service department of
Reinhardt Maschinenbau GmbH
Tel.: 07031 / 863-0 Fax: 07031 / 863-185

If you try to save a program to a diskette which is write protected, the following message will appear:

```
- SCHREIB FEHLER !
```

Check the diskette and move the write protection tag (see 11.1.1 About diskettes). Then insert the diskette again and save the program.

CAUTION:
- If you save a program in a slot that is already occupied, the existing program will be deleted and overwritten by the new one!
- A program without a name or number is not entered in the diskette directory when it is saved.

Deleting programs on diskette

Delete the program information of the current bending program in the program input level.

Choose the soft key function to go to the diskette manager, and move the cursor onto the program you want to delete.

Choose the soft key to overwrite the existing program with an "empty program".

Loading programs

Use the cursor keys to move the cursor to the line containing the program you want to load.

Choose the soft key to load the program from the diskette into the controller's memory.

IMPORTANT: If there is a bending program in memory, it will be replaced by the program you are loading from the diskette. You should first save the existing program to diskette if you do not want this to happen.

Hints

You should save programs in a sorted order to keep them clearly arranged. For example, sort them by ascending numbers, by part groups, or by program families.

Diskettes do not cost very much, so there is no point in trying to save space with them. (It isvery annoying to lose data on a diskette that has been damaged or can no longer be read.)

- Make backup copies of your program diskettes.
- Keep your programs sorted.
- Label and file your diskettes so that bending programs will be easy to find later.

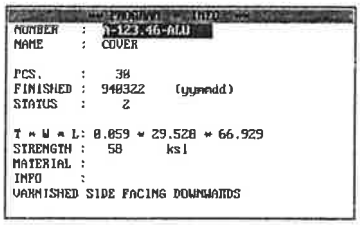
11.1.4. Reading program information

The program information contains details about a bending program.
In the diskette manager you can read the program information for each stored bending program.
Reading the program information does not load the program into memory!

Proceed as follows:

Use the  cursor keys to move the cursor to the slot with the program you want to read. Use the  soft key to retrieve the program information.

The following window is displayed:



To clear the program information from the screen, press the  soft key again.

Note: You cannot make changes to the program information from the diskette manager (to do this, see 6.4 Entering program information).

11.1.5. How to find programs

This function lets you very quickly find a certain program on your diskette. You don't need to browse through the entire directory.

Use the  cursor keys to move the cursor to the first line of the diskette manager.

Press the  soft key, and you will see the following window:

Searching for a program name

We are looking for a program called "COVER" on the diskette. Move the cursor to the "NAME" line.

Choose the  soft key to activate the typewriter, and enter "COV" (the first few letters of the word "**COV**ER" are enough).

Press the  soft key again to start the search. The controller will find the next program that begins with "COV". If there is more than one program that starts with these letters, you can press the  soft key repeatedly to display them one after the other.

You will notice that the cursor has moved to the line with the program found by the controller.

If it is the right program, load it into memory with the  soft key.

If the controller cannot find a program beginning with "COV", it will display this message:

Searching for a program number

To search for a program by its number, simply enter the number (or the first few digits) in the "NUMBER" cursor position.

As described above, start the search by pressing the FIND soft key.

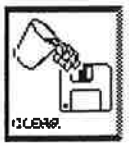
Searching for a production date

If your programs are centrally managed in the work preparation area, you can group the programs for an entire week.
In this case the work planner writes the production date in the "DATE" line of the program information level.

The machine operator can now use the search function to find all programs with the same production date.

Note: For external programming and program grouping, we recommend our external programming software package. It is available directly from:
Reinhardt Maschinenbau GmbH
Richard-Wagner-Strasse 4-10
71065 Sindelfingen
Tel.: 07031 / 863-0 Fax: 07031 / 063-185

11.1.6. Formatting (deleting) a diskette



Before you can write a program to a new diskette, you must format the diskette.
The formatting process divides the diskette surface up into fixed sectors and tracks, and creates a directory.

CAUTION: Formatting a diskette destroys all data on the diskette. We have therefore labelled the soft key "Clear" to indicate the risk of losing data.

Proceed as follows:

Choose the  soft key to go to the diskette manager. Insert the new diskette in the drive.

Press the  soft key. You are then prompted for the code number.

CODE ?

Enter the code number and confirm by pressing the  soft key again.

The activated  soft key icon is shown in reverse video while the controller is formatting the diskette.

IMPORTANT:
- It takes about 2 minutes to format a diskette.
- If the controller aborts the formatting procedure before it is complete, the diskette will not be correctly formatted.

Causes:
- False diskette type ("HD" instead of "DD").
- The diskette is defective.
- The diskette is still write protected (see 11.1.1).

The following error message will appear:

```
- DISK HARDWARE FEHLER!
```

Otherwise the following message will appear:

```
- DISK FALSCH FORMATIERT!
```

11.1.7. Copying a diskette using a PC

It is advisable to make backup copies of your program diskettes.

IMPORTANT:
- You can only make copies of diskettes on a PC if the diskette was formatted by the Multibend controller (see 11.1.6).
- The PC must have a 3½" diskette drive and must be running the MS-DOS operating system.

Once you have formatted the backup diskette in the controller, take the source diskette (with your program) and the destination diskette (for your backup copy) to the PC and insert the source diskette in the diskette drive of the PC.

To copy the diskette, use the DOS command:

"DISKCOPY".

If the 3½" drive on the PC is designated as drive A, enter:

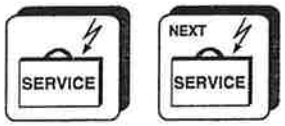
>DISKCOPY A: A: ↵ Return

If it is designated as drive B, enter

>DISKCOPY B: B: ↵ Return

The PC operating system will now prompt you for the source or destination diskette.
For more details of this, please refer to your MS-DOS User's Guide.

12. Service level



12.1. Fundamentals

The service level provides a complete status report on all axes and on all inputs and outputs of the folding machine.

Choose this key to enter the service level at any time and from any part of the program. The Multibend controller has two video controllers which deal with screen output.

1) Controller for the service level.

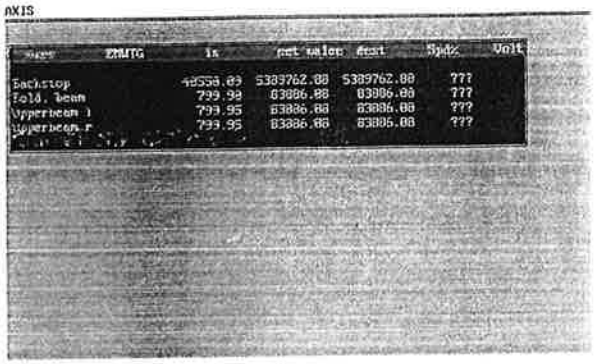
2) Controller for the application level.

Use the  key to toggle between the two video controllers.

The  key displays the second service level with the inputs and outputs.

The service level is for diagnostics only, and is used for:

- troubleshooting
- maintenance and servicing work.



IMPORTANT: No inputs are possible in the service level. The key functions remain in effect for the most recently active window.

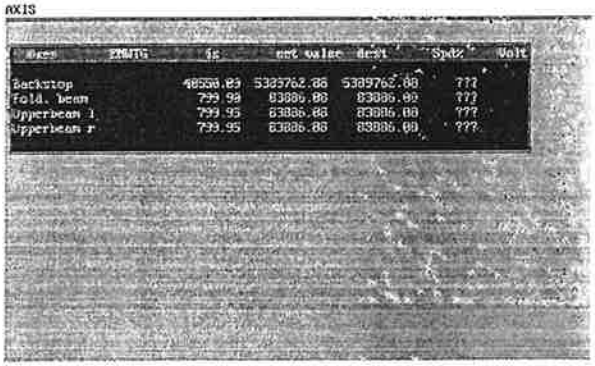
Example: You were in the PROG EDIT level and activated the service level. By pressing the CL LINE and ENT = keys simultaneously, you can delete all 40 lines of the program input (see also 6. Program input).

Exit the service level by pressing the flashing SERVICE key.

12.2. Axis functions

The top half of the screen in the service level lists all axes of the folding machine, providing a quick overview of the axis status of the machine.

Backstop	positioning axis of the backstop
Bending beam	bending beam swing axis
Upper beam l	open/close upper beam left
Upper beam r	open/close upper beam right



Letter keys in the EMWTG column:

If a letter is shown in reverse video, the condition is met.

E	=	enabled:	Axes switched on.
M	=	move:	Axis is moving.
W	=	wide toller:	Extended axis tolerance range is active.
T	=	toller:	Positioning window of the Save parameters is active.
G	=	calibrated:	Axis is calibrated.

Explanation of the columns:

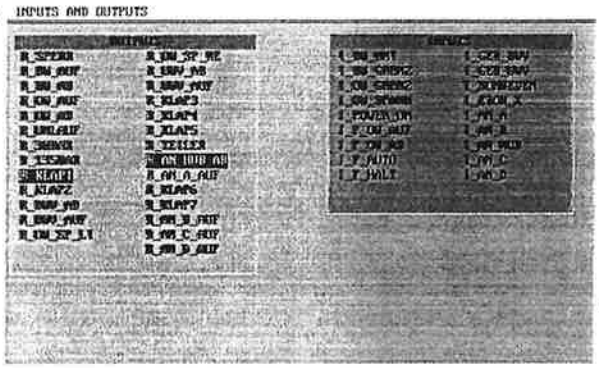
Act:	Actual position of the axis.
Set:	Setpoint position of the axis. This value is calculated by the controller. It indicates the position the axis is to move to within a certain period.
Target:	Target position of the axis. This is the value you entered in the program.
Spd%:	Setpoint output in % (speed of the axis).
Volt:	Setpoint output in volts.

Notes:

12.3. Inputs/outputs

The  key displays the second service window for the inputs and outputs.

An input or output is set if it appears in reverse video (see figure).



Explanation of inputs and outputs:

Outputs:	Reverse video
R_SPERR	Enable - backstop control enabled.
R_BW_AUF	Bending beam moving upwards.
R_BW_AB	Bending beam moving downwards.
R_OW_AUF	Upper beam opening.
R_OW_AB	Upper beam closing.
R_UMLAUF	Pressureless hydraulic circulation.
R_30BAR	Upper beam clamping at 30.4 atm (30 bar) hydraulic pressure.
R_135_BAR	Upper beam clamping at increased pressure 131.72 atm (135 bar).

Outputs:	Reverse video
R_KLAP1	First flap row of backstop is active.
R_KLAP2	Second flap row of backstop is active.
R_BW_AB	Bending beam adjustment moving down.
R_BW_AUF	Bending beam adjustment moving up.
R_OW_SP_LI	Left valve for closing the upper beam is closed. In conjunction with the portioner, this valve can close to move the upper beam down parallel.
R_OW_SP_RE	Right valve for closing the upper beam is closed. In conjunction with the portioner, this valve can close to move the upper beam down parallel.
R_UWV_AB	Lower beam adjustment moving down.
R_UWV_AUF	Lower beam adjustment moving up.
R_KLAP3	Third flap row of backstop is active.
R_KLAP4	Fourth flap row of backstop (optional) is active.
R_KLAP5	Fifth flap row of backstop (optional) is active.
R_TEILER	The portioner of the upper beam is active. The portioner is automatically activated when an upper beam closing height is entered.
R_AN_HUB_AB	Frontstop (optional) on the bending beam moving down.
R_AN_HUB_AUF	Frontstop (optional) on the bending beam moving up.
R_KLAP6	Sixth flap row of backstop (optional) is active.
R_KLAP7	Seventh flap row of backstop (optional) is active.
R_AN_B_AUF	Stop finger B of frontstop (optional) moving up.
R_AN_C_AUF	Stop finger C of frontstop (optional) moving up.
R_AN_D_AUF	Stop finger D of frontstop (optional) moving up

Inputs	Reverse video
I_BW_UNT	Bending beam is down (0°).
I_BW_GRENZ	Bending beam has reached the electromechanical limit switch on the left side column.
I_OW_GRENZ	Upper beam has reached the upper limit switch while opening. Max. opening height 15.748 inch (400 mm).
I_OW_SPANN	Pressure switch has switched off upon reaching clamping pressure, the upper beam is clamped.
I_POWER_ON	Machine power is on.
I_F_OW_AUF	Left "Upper beam" foot switch fully depressed (2nd position). Upper beam opening.
I_F_OW_AB	Left "Upper beam" foot switch pressed (1st position). Upper beam closing
.I_F_AUTO	The controller is in Auto Start mode. Complete bending cycle, i.e. close upper beam with left foot switch, start bending beam with right foot switch.
I_F_HALT	Right "Bending beam" foot switch fully depressed (2nd position). Bending beam motion halted (see 8.8 Interrupting the bending process).
I_GEB_BWV	Bending beam adjustment transducer is counting revolutions. Free / actuated = 1 pulse
I_GEB_UWV	Lower beam adjustment transducer is counting revolutions. Free / actuated = 1 pulse
I_SCHWEDEN	9.945 inch (24 mm) safety stop active. Always active as soon as the upper beam descends from a height of more than 0.9445 inch (24 mm). To close further, press the "Upper beam" foot switch again.
I_EICH_X	Limit switch of backstop actuated.
I_AN_A	Stop finger A (optional) lowered.
I_AN_B	Stop finger B (optional) lowered.
I_AN_HUB	Complete frontstop (optional) lowered.
I_AN_C	Stop finger C (optional) lowered.
I_AN_D	Stop finger D (optional) lowered.

Notes:

13. Important messages / error messages

We have provided an alphabetical list of the most important messages and error messages.

Important messages:

Close beam with foot switch!

After switching machine power on after calibration, the controller prompts you to close the upper beam (see 4.2 Calibration).

Input value from the scale!
Input in mm

When calibrating the machine you are prompted to read and enter the current values of the bending beam and lower beam adjustment (see also 4.2 Calibration).

>SAVE PARAMETER <
-- NOT FOR UNAUTHORIZED --

You are in the Save parameters level.

IMPORTANT: Do not change these values without first consulting the after-sales service department of Reinhardt Maschinenbau GmbH.

Error messages:

Beam exceeded

The most recently entered tool length has exceeded the available working length of the machine. Check and correct the input.

Bending beam stopped / position control

You interrupted the bending process with the right "Bending beam" foot switch.
For details on how to proceed, please refer to section 8.8 Interrupting the bending process.

- DISK HARDWARE ERROR !

This error message is displayed when you try to format a defective diskette with the 

soft key function.
The diskette cannot be formatted due to bad sectors. Throw the diskette away.

- DISK INCORRECTLY FORMATTED !

The diskette was write protected when you tried to format it with the 

soft key function.

Remove the diskette and move the write protection ag (see sections 11.1.1 and 11.1.6).

Error!

When calculating with the calculator  , you used an illogical mathematical input.

Example: divide by zero (see also 5.5 Calculator).

Gap too small

The controller cannot calculate the entered tool length.

Reasons:
- No tools are defined in the specified tool set.
- You do not have enough tools for the desired rail length.
- The specified tool length is shorter than the shortest adaptor.

- INCORRECT CODE !

You entered an incorrect code number. Repeat the function and enter the correct code.

INTERNAL ERROR, PLEASE RESET ...

This error message can appear on the screen when you switch the machine on.

Cause: Partial loss of Save parameter data.

Please contact the
After-Sales Service Department of
Reinhardt Maschinenbau GmbH.

No left corner

There is no left corner piece in the desired tool set for setting up the upper beam tools.
Check the entries in the Tool management level (see 6.8.2 Upper beam tool position).

No right corner

There is no right corner piece in the desired tool set for setting up the upper beam tools.
Check the entries in the Tool management level (see 6.8.2 Upper beam tool position).

out of range !

Minimum value Maximum value

You entered a value that is too high or too low. When you move the cursor with the cursor key, this message will appear. The controller tells you the range for the input.

PARAMETER TOO HIGH !

The entered parameter value is too high. When you exit the PARA DATA level, this message will appear at the top of the screen.

Check the parameter values. You can restore default values by pressing the CL key (see also 6.9 Parameter data).

PARAMETER TOO LOW !

The entered parameter value is too low. When you exit the PARA DATA level, this message will appear at the top of the screen.

Check the parameter values. You can restore default values by pressing the CL key (see also 6.9 Parameter data).

- PROG NOT FOUND !

The controller cannot find the program you are looking for on the diskette. Insert the correct diskette and repeat the search with the FIND soft key function (see also 11.1.5 How to find programs).

- READ ERROR !

The controller cannot read the diskette you have inserted.

Causes:
- The diskette is not formatted.
- The selected program cannot be loaded. Repeat the procedure.

Upper beam tilt !

The tilt switch has interrupted the upper beam closing movement.
Open the upper beam with the left foot switch. Enter an upper beam closing height in the bending program for clamping the plate.

- WRITE ERROR !

The diskette is write protected, you cannot save the program to the diskette.
Make sure you have inserted the right diskette. Remove the write protection from the diskette (see 11.1.1 About diskettes).