# 1 TSSOFT

TSsoft from BOSCH is high-performance software for planning, designing and constructing BOSCH transfer systems TS1plus, TS2plus, Manual transportation MT and MTS2. TSsoft places at your disposal all the components in the BOSCH TS modular system and also includes functions which provide assistance during the design process.

These range from a sketching function for the transfer system through to calculation programs for questions which often arise during the design of transfer systems.

The whole program is rounded out with numerous functions to help you use AutoCAD.

This manual contains information about using the menus and special functions in TSsoft.

# 2 CONTENTS

## 2.1 FMSsoft documentation

The FMSsoft documentation is composed of various different parts:

- FMSsoft Installation Manual 5.9b
- Package-specific manual, e.g. TSsoft 5.9b
- Online help
- Readme.doc

**Note:** you will find the most recent alterations to the FMSsoft information and instructions in the *readme.doc* file.

## 2.2 Typographical conventions

Text elements which the computer indicates for you or which can be entered by you are displayed in different fonts and styles so that they stand out from the rest of the text.

**Formatting conventions**

| *Text element* | *Example* |
|---|---|
| The Return key | ↵ |
| Menu options, prompts and other text displayed on the screen are shown in Times New Roman | Command: SELECT<br>Module name ?/<default>: . |
| Text which you enter is shown in bold face Times New Roman | Enter **fms_module** in the command line |
| File names, directory names and comments are shown in italics | *c:\fms\fms.bat*<br>*drawing.dwg* |

# 3 OVERVIEW

Over the next few pages you will find a brief introduction to TSsoft and what it has to offer you.

## 3.1 Planning and designing transfer systems

For production planners in companies, computer system retailers or design agencies involved in production planning, **TSsoft** is the ideal tool for planning and designing BOSCH transfer systems.

**More reliable planning**

First, the basic parameters of a transfer system are defined. The basic parameters would, for example, be the dimensions of the workpiece pallet or the height of supports. These values apply for the entire system. Setting these parameters ensures that all the different components in the system are compatible.

**Planning quality**

You can use special calculation functions to work out belt lengths, workpiece pallet exchange times, the total number of workpiece pallets in the system or the number of drives required.

**Sketches during the planning phase**

With the special sketching function, you can first make a rough design for the transfer system. In this way, various different versions of a transfer system can be drawn up extremely quickly for comparison with one another. And this does not mean sacrificing accuracy, since the outer contours shown are drawn to scale and are also checked for plausibility.

But the benefits don't stop there...

At just the push of a button, you can convert these sketches into "proper" 3D layout designs. The 3D graphics are self-explanatory and easy to use, even for those who are not technically minded.

**Changes are easy to make**

With the highly-developed functions, changes to construction elements are extremely easy to make. Alterations of this kind might be extending or shortening conveyor sections, exchanging drives or changing parameters.

**Calculation of accessories**

TSsoft automatically calculates which accessories are needed. This covers connecting elements, electrical and pneumatic accessories and belts. Now nothing can ever be overlooked!

**Macros maintain standards**

Have you developed your own standard for the construction of Bosch transfer systems? If so, you now have the option of programming these standards. A program like this helps you maintain standards. Standards reduce planning work and improve quality.

Programming is carried out in AutoLISP, which is fast to use and easy to learn.

**Maximum productivity with TSsoft!**

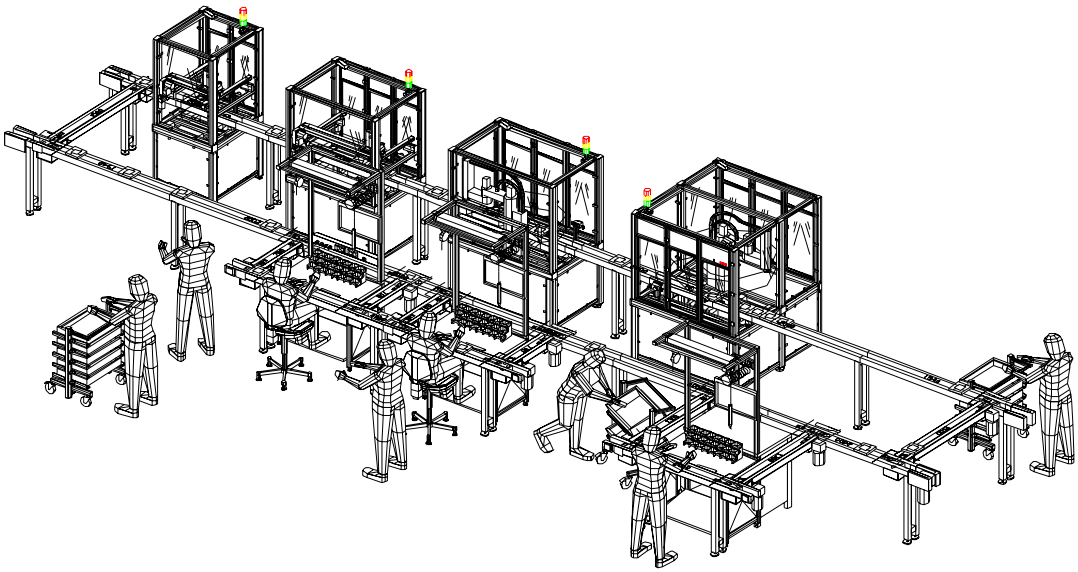
TSsoft is also in a class of its own when it comes to selecting and positioning construction elements. **Parts which logically belong together**, e.g. supports, sections, lateral transports, etc. or the elements for junction control are **selected** in a **common** selection mask. Then the graphics for all the construction elements required are generated automatically and inserted in their correct positions. All you have to do is select the "global" point at which the rectangular conveyor or the transport-function unit for junction control should be inserted. Dozens of construction elements in a transfer system can be inserted in the CAD drawing in this way in just a few seconds.

**The advantages**

TSsoft lets you use **modern design methods**. Take **simultaneous engineering**, which means the planner can, for example, modify the transfer system constantly as stations are altered. This is particularly easy if all the other production equipment and stations have also been designed and drawn in AutoCAD.

**Rationalisation:** this is a direct effect of the 3D illustrations. These are self-explanatory, even for those who are not experts involved in the planning process, and reveal faults, provoke you to try different solutions, and provide a more concrete and well-organised basis for every discussion. Every drawing helps co-ordinate a discussion.

Experience using TSsoft has confirmed this fact!



# 4 TSSOFT MENUS

This section provides information about how to find the components for workplace design in your menus and how the pull-down menus are organised.

## 4.1 Pull-down-Menu

Two submenus have been added to the standard AutoCAD menu: *MODULES* and *TOOLS*

## 4.2 *TS2 MODULES*

The ***TS2 MODULES*** menu is for selecting and inserting construction elements and, like the current TS catalogues, is divided into:

**TSStart**

**BOSCH Catalogue**
**Function Modules**
**Section Elements**
**Trans./Lift/Pos. Unit**
**Control Elements**
**Miscellaneous**

## 4.3 *TOOLS*

The ***TOOLS*** menu contains all other functions.

*Moving from one FMSsoft package to another:*

| | |
|---|---|
| **Package** | MGEsoft<br>MASsoft<br>TSsoft |
| **Draw** | Cnode<br>Form<br>Preplot<br>-------<br>DIM Layer<br>  Plan view<br>  Side view<br>  Front view<br>TEXT Layer<br>  Plan view<br>  Side view<br>  Front view<br>GRAPHIC Layer<br>-------<br>Modblock |
| **Image** | Fade<br>Clip<br>Switch<br>Modlay |
| **Change** | Change Module<br>Stretch Module<br>Module Name<br>Disass<br>Join |

*Parts list functions:*

| | |
|---|---|
| **Partlist** | Ptlist |
| | Magnifier<br>Item no. |
| | PriceEdit |
| | PriceUpdate |
| | ChangeLanguage<br>Assembly |
| *Multiple windows:* | |
| **Views** | Initialise<br>Reset<br>Single viewport<br>Swap |
| *Edit functions* | |
| **Construct** | 2D-move<br>2D-copy |
| **Layer** | Change layer<br>Set layer |
| *TSsoft special functions* | |
| **Planning functions** | TS Turbo<br>Trans media length |
| | Qty Drive Modules<br>TSsoft help |
| | TSsoft info |
| | Game |

Information about the planning functions and how to use the functions for the multiple window (see TIPS on page 11) is provided in this manual. For information about the other functions please see the FMSsoft manual 5.9b or the Online Help.

## 4.4 Where can I find the components in the menu?

You have found a component in the FMS catalogue you would like to use and now you want to know how to find it as quickly as possible in FMSsoft.

There are several ways of looking for a component:

- Using the Search function you can look for the part by order number or name. The command to call the search function is: **BOSCH**.
- You can use the CHOOSE command to display all the modules available (or just certain modules):
  Command: **CHOOSE**
  Module name ?/<name>: **?**
  Search command <*>: ***** *for all modules or a string (wildcard character...)*
  **see also:** CHOOSE
- You can also use the pull-down menus. These menus are arranged in the same way as the articles in the catalogue.

# 5 TIPS

When you use a computer for design work things tend to get very complicated, and you often feel there are so many lines that you can't see anything. Here are a few tips to help you keep track of things and work more quickly with FMSsoft:

## 5.1 Several viewports for greater clarity!

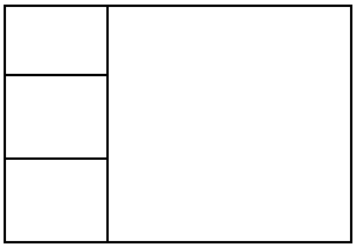
You should try and begin to work in several viewports as early on in the design process as possible e.g. as soon as you have inserted a work table or a Manmodel. In FMSsoft you can use the **Views** option in the ***Tools** pull-down menu for this purpose.

This includes three functions:

**Initialise** Initialises arrangement of the viewports with the front, top and side views in three smaller viewports and the ISO view in the main viewport

**Reset** Returns to the last viewport arrangement saved after the last initialisation.

**Swap** Swaps the view in a smaller viewport to the main viewport.
Example: the top view is in a small viewport. Your cursor is also in this viewport. On the SWAP command, the top view is also shown in the main viewport.



**Single Viewport** Use this to return to single viewport viewing. The view for the resulting single viewport is inherited from the current viewport.

It is also very sensible and useful to use several viewports during ergonomic tests with the Manmodel.

## 5.2 Editing in the top view?

If so, you should certainly use the 2DMOVE and 2DCOPY commands. These commands ignore the Z co-ordinates of the digitised points and prevent the elements which were previously on the table ending up on the floor.

## 5.3 Specified user coordinate systems

When positioning modules, e.g. at table-top height, you should first set the UCS to the right height. To do so, use the AutoCAD command UCS |Origin and select a new point of origin, e.g. the top left-hand corner at the front of the table top. Then save this UCS with the UCS command Save option. You can use a name like T1000, where T stands for table and 1000 for the table height.

## 5.4 Macros for selecting and inserting modules!

The following macros are included in TSsoft:

CIRCIUT++
SHUNTUNIT++
TFE++

You can use these to insert not only individual elements, but also accessories and related modules which speeds up the entire selection and positioning process considerably.

In addition to the macros, which do not have any superior parts list information, the following modules are realised in TSsoft as complex modules:

LEGSET
SECTION
WORKPIECEPALLET

## 5.5 Different layers structure the drawing

It is standard for all modules to be inserted in the MAS layer. They are then shown in the colour of this layer.

In order to work with certain elements only, for example all those on the table top, proceed as follows:

1. Call CHGLAY and select all the parts you want to arrange on the table. Don't forget the table top!
2. Give these parts the new layer name ONTABLE and select the colour CYAN.
3. All the selected elements will now be shown in CYAN.
4. Set the current layer to ONTABLE. This is easiest with the SETLAY command. Now select one of the cyan-coloured elements.
5. Now freeze the MAS layer (AutoCAD-command _DDLMODES)

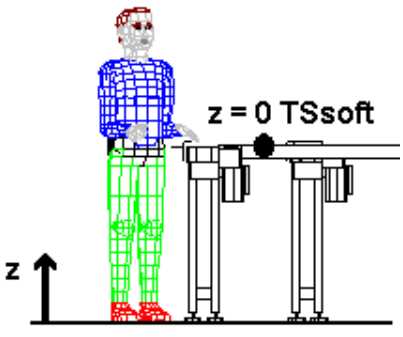
You will now see only the table top and the elements you want to position.

You can, of course, also use this method in a larger scale.

## 5.6 Changing between the TSsoft, MAS and MGEsoft packages

When changing between the TSsoft, MAS and MGEsoft packages ( *TOOLS* | packages...), you must take the following into account.

1. The origin of the co-ordinate system in packages MAS and MGEsoft is at a level of z=0 in the world co-ordinate system. In other words, you could say it is lying on the floor.
2. In TSsoft the origin of the co-ordinate system is at transport level. The (user) co-ordinate system is set by the **TSSTART** program using the transport level given there.




**Procedure:**

- **TSsoft ➔ MAS or MGEsoft**

If you want to move from TSsoft to MAS or MGEsoft, first save your current UCS

Command : **UCS** ↵
Origin/.../Save/..../<World> **S**↵
?/Desired UCS name: *enter a name, e.g. TS980*

Then reset the co-ordinate system to world, so that, for example, a work-table is standing on the floor:

Command: **USC** ↵
Origin/..../<World> ↵

- **MAS or MGEsoft ➔ TSsoft**

If you want to move from MAS or MGEsoft to TSsoft, retrieve the UCS you have stored:

Command: **UCS** ↵
Origin/.../Restore/..../<World> **R**↵
?/Name of UCS to restore: *enter the name of the UCS you have saved: :e.g. TS980*

or use the **DDUCS** command.

# 6 TSSOFT PLANNING FUNCTIONS

The special commands in TSsoft provide you with comprehensive planning and calculation functions in TSsoft.:

**TSTURBO** is used for **sketching** and inserting transfer systems, cable ducts and air supply lines.

**MEDIALENGTH** calculates the **length of the conveyor media** e.g. the belt.

To help you with the question of **how many workpiece pallets you need** in a system, you will find the **WPPQTY** command.

**WPPTIME** calculates **the workpiece pallet exchange time** between preliminary and main stop gates.

**DRIVE** helps you plan the layout of transport sections by calculating the **number of drives required**.

## 6.1 TSturbo

### TS Sketching and inserting transfer systems, cable ducts and air supply lines.

Presettings

Procedure

Entering points

Format:
Command: **TSTURBO**
TSturbo ** current transfer system : TS 1 BWT=120 LWT=120**
Parallel/Opposite/Cable/Air/Generate/ERase/Sketch/Layout/Undo/<Exit> or Point:

### 6.1.1 *Presettings*

If TSturbo is called, a status message is given which shows which transfer system has been selected with the TSSTART program, e.g.:

** Current transfer system : TS 1 BWT=120 LWT=120**

TSturbo works with these values. If you would like to use different values, run TSSTART again and change the relevant parameters.

**TIP:** In addition, the characteristics which cannot be set by the program can be determined before generation using the selection dialogues. The following values are set by the program and can therefore not be altered:

| | |
|---|---|
| KTS2 | : type, L, total length, direction of travel. |
| SE2 | : total length, position of motor |
| EQ2 | : type, L |
| Cable duct | : type, L, B |
| Air supply | : type, L |
| TFE | : type, mechanical variations, coding (ID 80!) |

### 6.1.2 *Procedure:*

**EXAMPLE:** Using Tsturbo, you want to generate a conveyor unit SE2 with a conveyor length of 5600 mm and a distance of 3000 mm between the leg sets.

- Select the relevant characteristics in the SE2 dialogue box (see **CHOOSE**).
- Start **TSturbo**
- Enter the two points which define the length of the conveyor unit
- Convert the sketch into TS2 elements with Generate.

## 6.1.3 *Entering points*

TSturbo expects you either to enter an option or digitize points. If points are entered, the following may occur:

- Digitisation of two points horizontal to one another:

  If two points horizontal to one another are selected, TSturbo sketches a conveyor section. The longitudinal direction of transport here is shown with an arrow. The optimum distances between lateral sections are indicated clearly with horizontal lines.

- Digitisation of two points vertical to one another:

  If you enter points positioned vertically, it is assumed that you want to sketch a lateral section. If the points are set in close proximity to existing elements in the sketch, TSturbo seizes the sketch points. The optimum distance from drives and return units can be set by clicking the horizontal lines on the conveyor unit.

  The direction of travel on the lateral section is indicated by an arrow.

- Digitisation of two points diagonal to one another:

  If the diagonal crosses over other elements, e.g. a conveyor section, the Tsturbo opts in this case for a shunt workstation, which is inserted in an existing section. If there are no other elements under the diagonal, the symbol for a rectangular conveyor is inserted in the drawing.

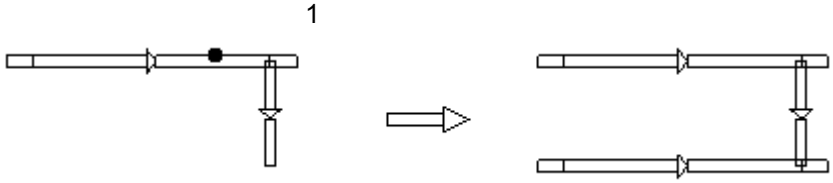
So that you can work with precise dimensions right from the planning phase, you have the option of overwriting the digitised values. All entries are checked to ensure they are within the technical limit values of the transfer system. If the limits are exceeded, Tsturbo issues an error message.

## 6.1.4 *Parallel*

With the >**Parallel**< command, you can draw sketch elements again in a different position (transposed). The transport direction of these elements remains the same. If a conveyor section is selected for parallel transposition and is already joined to a lateral section element, TSturbo automatically enters the suitable conveyor unit at the correct distance. The same happens with a lateral section. If the lateral section is connected to a conveyor section, the correct distance is calculated and the suitable lateral section inserted in the correct position. If the distance is not obvious from the sketch, you can set the position and distance of the transposed sketch element yourself.

**EXAMPLE:**

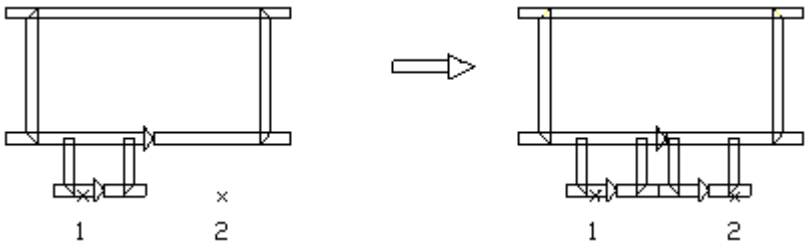
You have sketched a conveyor section and a lateral transport attached to it. In order to draw a parallel conveyor section of the same length at the other end of the lateral transport, select the >**Parallel**< option and digitise the conveyor section. TSturbo will do all the rest for you.



Shunt workstations and rectangular conveyors are copied next to one another when the >**Parallel**< option is selected. TSturbo calculates the minimum distances and suggests them as settings.

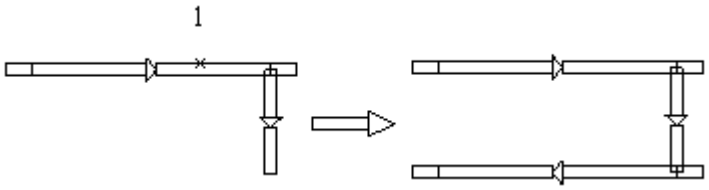
**EXAMPLE:**

You have sketched a shunt workstation at the left-hand end of a rectangular conveyor and want to insert more towards the right as close as possible to one another. Select >**Parallel**<, click the shunt workstation, digitise a point to the right of the shunt workstation for the direction, and accept the suggested distance with the Return key.

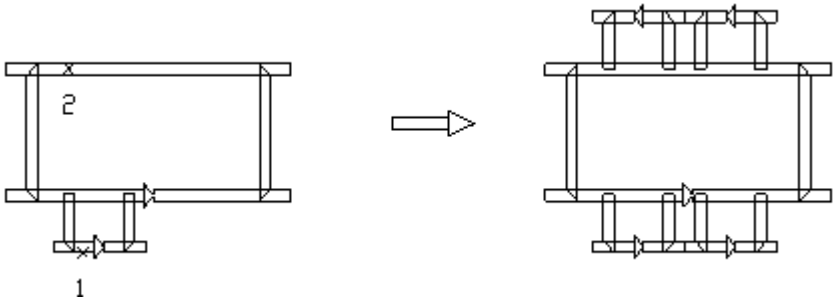



## 6.1.5 *Opposite*

In principle, the >Opposite< option has the same effect with conveyor units and transverse sections as the >**Parallel**< command. The only difference is that the transport direction on the new element in the sketch is drawn in the opposite direction.




It is useful to position rectangular conveyors and shunt workstations with differing directions of travel opposite to one another. For this reason, you should select a point above or below the sketch element for the direction.

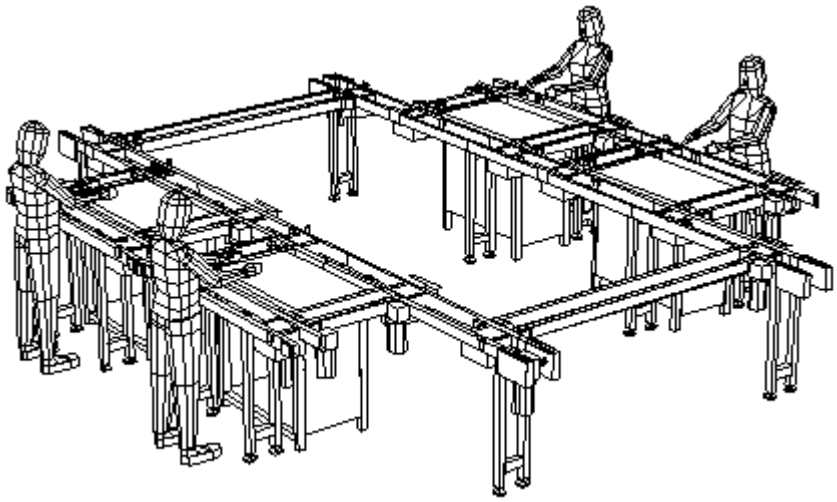



## 6.1.6 *Cable and Air*

The >Cable< and >Air< commands allow you to draw supply lines. These supply lines are shown simply as lines which indicate the direction of flow. With the >Cable< command, you can draw the symbols for cable ducts, and >Air< is used for drawing air supply lines.

## 6.1.7 *Generate*

The major strength of TSturbo is that all sketch elements can be converted into proper transfer components. To generate the elements, you digitise the sketch elements you have previously created. You can do this in just some parts of your layout or for the entire transfer system.



## 6.1.8 *ERase*

In order to compare different transfer systems with one another, it is sometimes necessary to sketch several variations and to implement or delete them. The >**ERase**< option is provided for deleting parts of your design, leaving plenty of room for your new ideas.

## 6.1.9 *Sketch and Layout*

The menu points Sketch and Layout let you choose different ways of viewing your transfer system. With the >**Sketch**< command, all the elements in the sketch are visible, while all the layout components disappear. The layout components such as transfer elements, control elements, cable ducts and air supply lines can be activated either individually or together with the >**Layout**< option.

The different layer names for the sketch elements are:

| | |
|---|---|
| FMS_SKETCH | for the transfer elements |
| FMS_SKETCH_CABLE | for cable ducts |
| FMS_SKETCH_AIR | for air supply lines |

**Caution:** in order to save on time, the layers are simply switched off with these options and not frozen. If you wish to fade out the hidden edges, you must freeze the layers beforehand which contain the elements you do not want displayed.

## 6.1.10 *Undo*

Every step taken in TSturbo can be reversed. To reverse a command, select the >**Undo**< option.

**TIP:** Don't have any reservations about experimenting with TSturbo. Try sketching elements, copying them parallel or opposite, and create several variations of the same thing. You can correct mistakes at any time with the Undo and ERase commands.

## 6.1.11 *Exit*

The **Exit** command is used to quit TSturbo. The last detail drawing is saved for the next time Tsturbo is called. The layer which was previously the current one is activated again and reset.

**Caution:** If the FMS_SKETCH sketch layer was active before TSturbo was called, it is activated again when TSturbo is quit, although the sketch elements have been faded out with the Layout option.

### 6.1.12 *Point*

See Entering points

## 6.2 DRIVE

**TS Calculates the number of drives required.**

The number of drives and return units needed in a conveyor section depends on:

- The load and size of the workpiece pallet (WPP)
- Number of WPPs on the conveyor section
- Permissible section load between drive and return unit
- The type of system, e.g. TS2plus (this piece of information is taken from the TSSTART program)

Format:
Command: **DRIVE**
** current transfer system: TS x; Bwt: xxx mm; Lwt: xxx mm**
Loading in kg: *Enter*

only with TS2plus: ASx drive type M/HM/S: *Enter*

Number of workpiece pallets on the conveyor section: *Enter*

Number of drive stations (and corresponding rev. units): x
Min. transverse section length between first drive module and last rev. u.: xxx m
Min. longitud. section length between first drive st. and last rev. u.: xxx m

## 6.3 MEDIALENGTH

**TS Calculates the length of the conveying media, e.g. the belt.**

The transfer system type is taken from the TSSTART program.

Format:
Command: **MEDIALENGTH**
Section length: *Please enter the length or define two points*
only with TS2plus: Conveying media Belt/Flat-top chain/Roller chain: *Enter*
Required belt or chain length: xxx mm

## 6.4 WPPQTY

**TS Calculates the number of workpiece pallets in the system.**

Format:
Command: **WPPQTY**
Number of manual workstations:

Number of workpiece carriers in the area of the workplaces <5>:
Number of automatic stations:
Number of workpiece carriers in the area of the stations <3>:
Number of workpiece carriers in the transv. conv. sections (rect. cfg):
Length of all interm. sections and conveyor sections in m:
Transportation speed in m/min (9 or 12 m/min):
Installation cycle time per workpiece carrier in secs.:
Number of workpiece carriers in the area of workplaces:

## 6.5 WPPTIME

**TS Calculates the time required to exchange workpiece pallets.**

The workpiece pallet exchange time is the time the workpiece pallet takes to travel from a preliminary to a main stop gate. Lift-out time is not accounted for.

Format:
Command: **WPPTIME**
Transportation speed in m/min (9 or 12 m/min) :
Distance in mm between the preliminary and the main stop gate:
The workpiece pallet exchange time (excluding lift-out time) is: xxx s