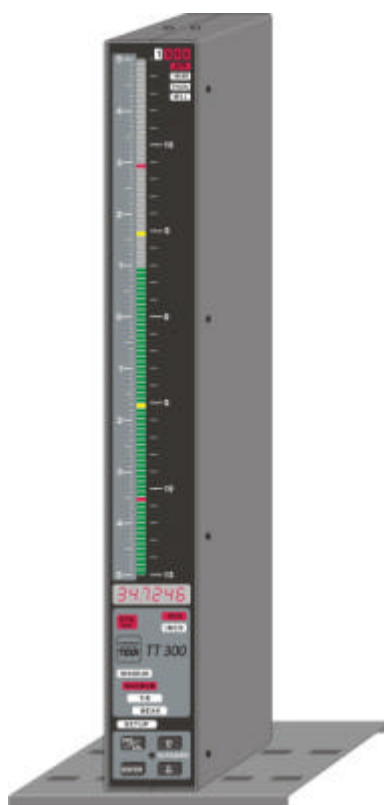




INSTRUCTION MANUAL



TESA TT 300

04030012 04030014

MERCER EL 300

04036012 04036014

Multi gauging Mode



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1. Introduction

1.1 General informationen

The column gauge TT300 is an electronic gauge supporting inductive probes, as well as sensors with analogue output voltages.

The compact design of the microprocessor-based electronics allows manual and automatic selection of 1...4 gauges.

Manual gauge selection :

- Selection of 1...4 different gauges one after the other by the keypad or foot switch.

Automatic gauge selection :

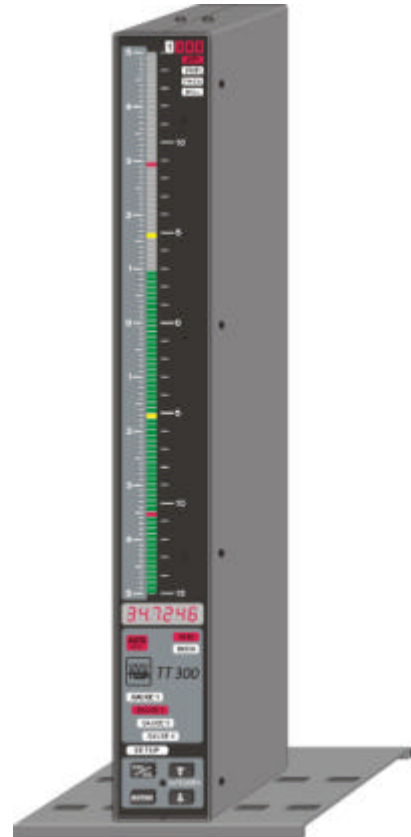
- Automatic recognition and changes of 1...4 hand gauges (bore gauges, air spindles etc.) with different settings

Highly sophisticated measurement programs simplify data acquisition and gauge calibration.

The numeric Display is designed for output of absolute measurement values, relative deviations and classification of the machined workpieces.

The three-coloured display features programmable tolerance marks, supports an accurate assessment of processing quality and is an ideal tool for quick quality checks on multi-gauging applications.

More sophisticated measurement applications are possible by interconnecting a row of column gauge.



1.2 Features

- ◆ **Manual selection of 1...4 gauges** : Switching by ENTER key or foot switch
- ◆ **Automatic selection of 1...4 gauges** : Automatic recognition of changes in measurement values and switching to the active gauge
- ◆ **Units**
mm and INCH selectable.
- ◆ **Measuring range / Resolution**
± 1,5 mm / 0.1 µm, 0,059 / 0.00001 inch
± 15 mm / 1 µm, 0,59 / 0.0001 inch (adjustment for long-stroke probes)
- ◆ **Numeric display ranges**
Relative measurements ± 9.9999 mm / ±99.999 mm, ±.99999 inch / ±9.9999 inch
Absolute measurements 0...99.9999 mm / 0...999.999 mm, 0...9.99999 inch / 0...99.9999 inch



◆ Column display ranges

± 1,5000 mm	± 0,15000 "
± 0,5000 mm	± 0,05000 "
± 0,1500 mm	± 0,01500 "
± 0,0500 mm	± 0,00500 "
± 0,0150 mm	± 0,00150 "
± 0,0050 mm	± 0,00050 "

The column display features 3 colours (red, green, yellow) with automatic colour selection corresponding to the given tolerance limits.

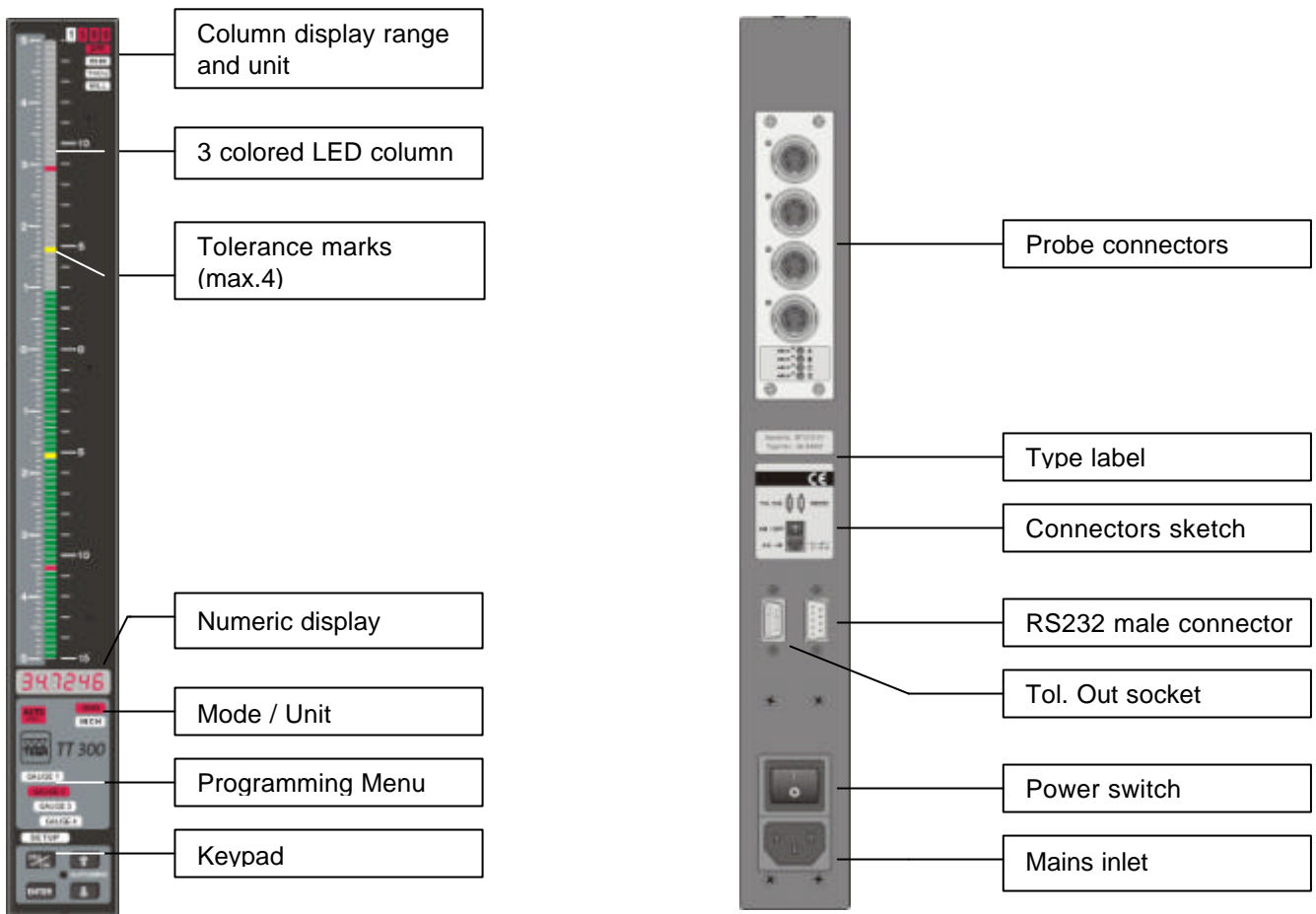
It is possible to program up to 4 tolerance limits.

Tolerance limits are marked on the column display.

Notice:

The measuring range of the column display can be set to a fixed value or to **AUTO** mode in the SetUP menu. In AUTO mode the display column automatically selects the smallest possible values applicable to the chosen tolerance range. The selected range is displayed in the upper right corner of the column.

1.3 Front panel and rear





1.4 Dimensions

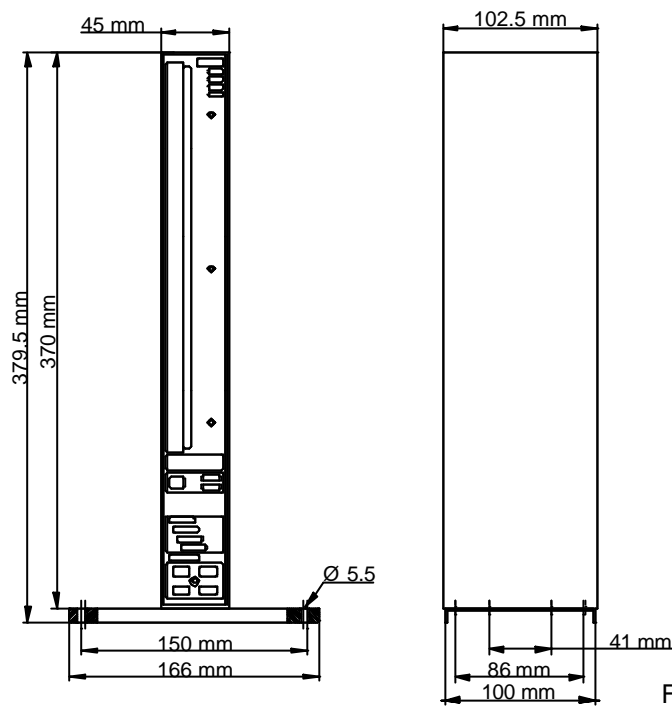
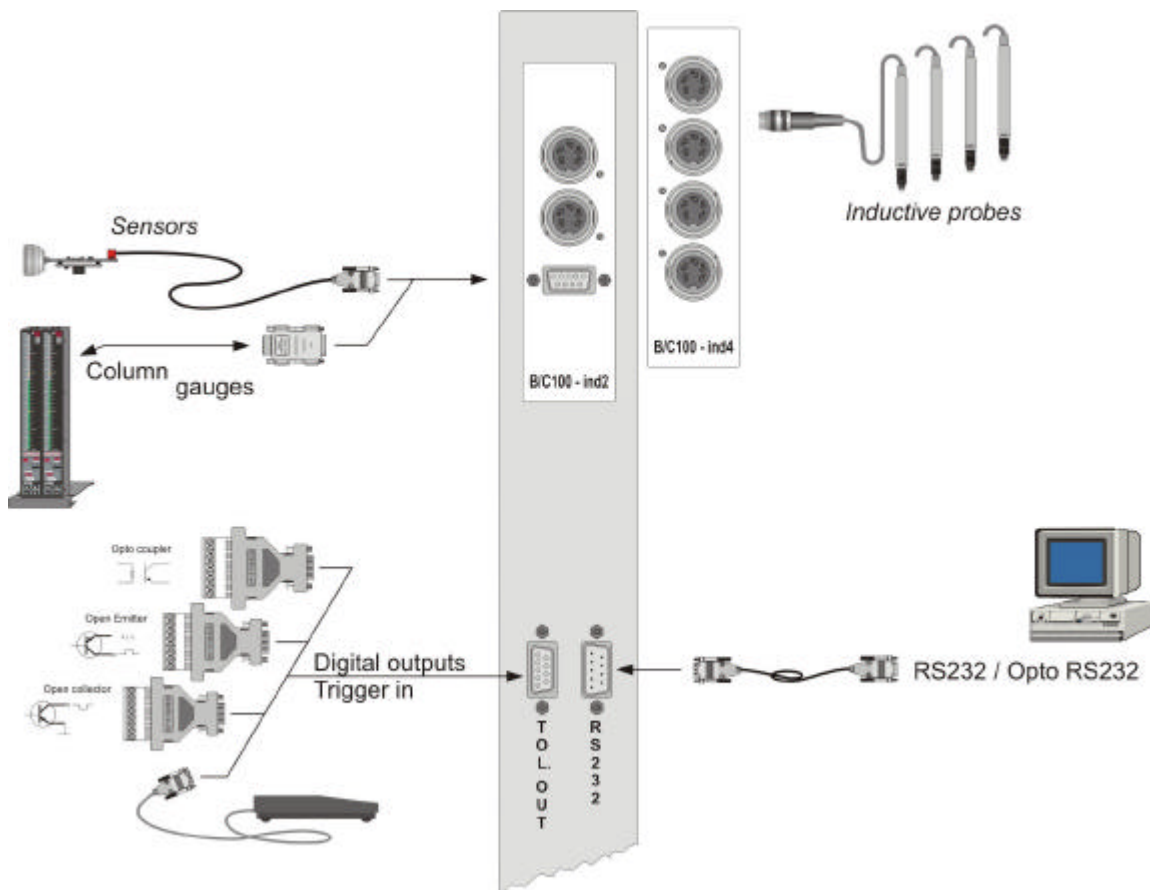


Figure :
Column display on footplate

1.5 Connectors roundup (all accessories shown)





1.6 Technical data

Mechanical characteristics

Case	Aluminium, epoxy powder coated
Front panel	Acrylic-glass front panel, anti-reflex
Keypad	Spring loaded keys for feedback with sturdy rectangular caps
Dimensions W x H x D / Weight	45 x 370 x 102,5 mm / approx. 820 g

Electrical characteristics

Power block	Primary switched power supply with wide voltage input
Main voltage / Frequency	85 ... 260 V AC / 47...440 Hz
Max. power consumption	5,5 VA

Display

Column display	Scale with 100 LED's, 3-coloured, 254 mm long, automatic colour selection and programmable tolerance marks
Numeric display	6-digit LED display; 6,4 mm, red
Mode, Unit, Range, Programming light fields	16 light fields with changeable labelling

Connections

-ind2 measurement module for 2 inductive probes, 2 analogue inputs & 2 output	2 DIN45322 sockets 5-pin and one 9-pin Sub-D socket with 2 analogue inputs and 2 outputs ($\pm 1,5V/\pm 10000$ Digit)	
-ind4 measurement module for 4 inductive probes	4 DIN45322 sockets 5-pin	
Probe Inputs: Drive voltage: Drive frequency: Calibration load: Sensitivity:	TESA TT 300 < 5 V rms 13 kHz 2 kO 73.75 mV/V/mm	MERCER EL 300 < 5 V rms 5 kHz 10 kO 50 mV/V/mm
Interface (RS232)	9-pin. SUB-D socket - Hardware according to EIA RS232 Standard - Data format according to OPTO RS232	
Trigger input / Tolerance outputs (Tol. Out)	9-pin. SUB-D socket Trigger input for ext. contact / foot switch and serial output for OC3, OE3 and OP3 adapters	

Measurement parameters

Measuring range / Resolution	$\pm 1,5$ mm/ 0,1 μ m or ± 15 mm / 1 μ m $\pm 0,059$ / 0.00001 inch or $\pm 0,59$ / 0.0001 inch
Resolution	16 Bit (internal)
Deviation of numeric display	0,5 % (at 20°C and 50 % rH)
Linearity	< 0.012 %
Hysteresis	< 0.005 %
Temperature drift gain	< 0.008 %/K
Zero point	< 0.008 %/K

Environmental conditions

Working temperature range	0...40°C
Storage temperature range	-30...+60°C
Relative humidity	For dry premises only
Type of protection	IP50

Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC)	Generation of armful interference according to EN50081-2 Resistance to armful interference according to EN50082-2
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2. Getting started

2.1 Delivered items

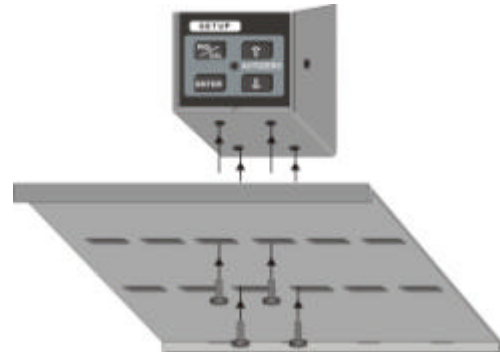
The column gauge comes with a power cable, a footplate (with 2 screws M3x6), an instruction manual and a programming card.

Further accessories, eg foot switches, adapters, etc. as listed in the delivery note.

Please, check the delivery for completeness and save the packaging for future use.

2.2 Mounting the footplate

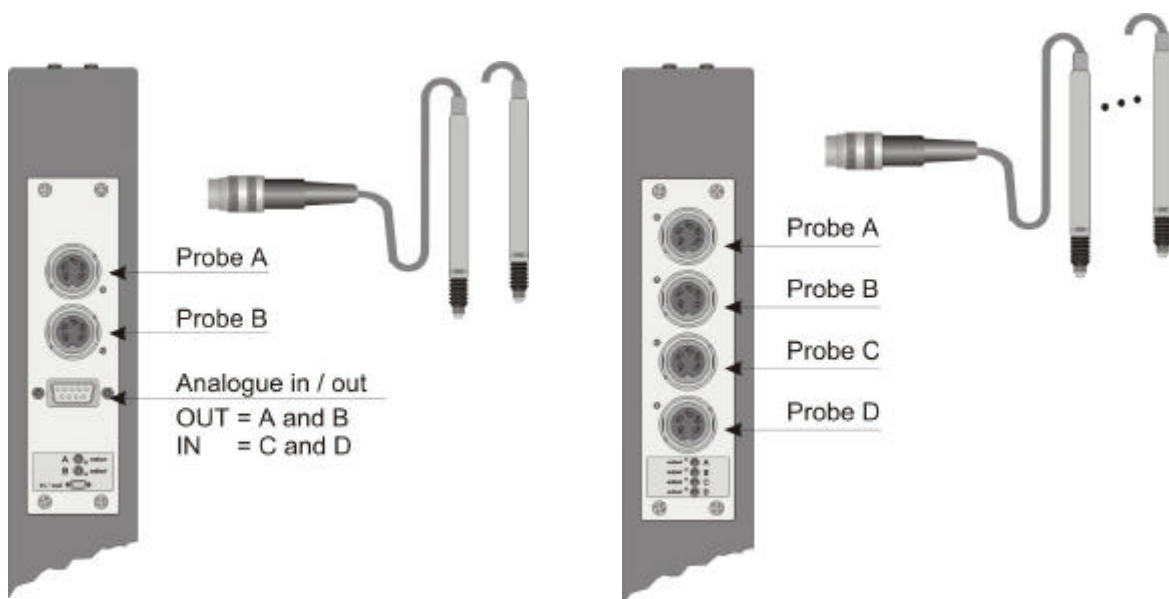
Secure the footplate to the column and place on a sturdy and level surface.



2.3 Connecting inductive probes

Compare the probe type with the specifications given on the label of the relevant measuring module. If they are compatible, connect them to the A and B or A, B, C and D connectors and secure with the threaded rings.

Caution !!! *Only a stable connection can secure a good contact of the gauge shielding and consistent measurement values.*





2.4 Connecting the AE6 Air/Electronic converter



- Probe A →
- Probe B →
- Probe C →
- Probe D →

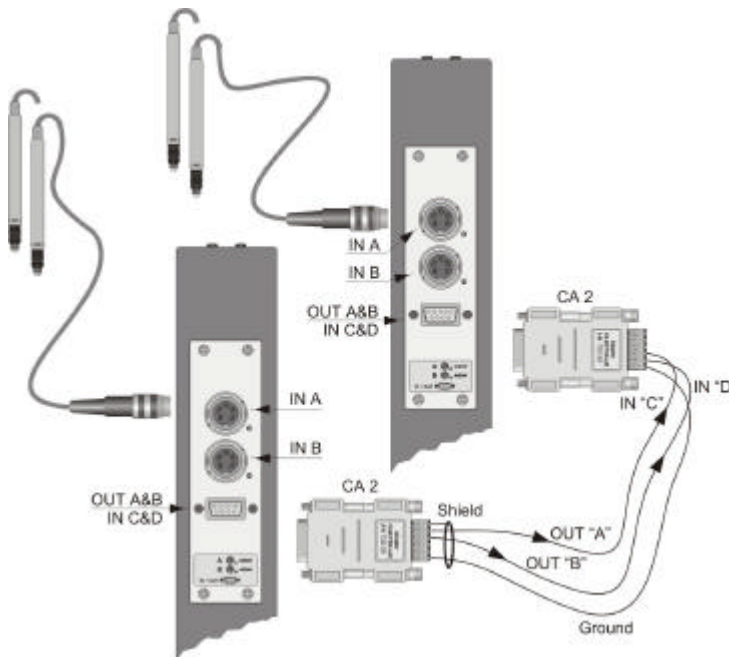


The probes from AE6 converters have to be connected to the A and B res. A, B, C and D inputs

2.5 Linking several column gauges and connecting analogue voltages

Linking of several columns and connecting analogue voltages is done with the help of the CA2 adapters, which are placed at the rear of the columns. The potentiometers mounted in the adapters allow an individual adjustment of incoming measurement signals.

Pin assignments are shown in chapter 6.1 and 6.2



Notice :
An analogues output may be simultaneously connected to several inputs (max. 3).

In the **Probe mixing** menu the two inductive probe inputs are to be found at the addresses A and B of the -ind2 module. Both analogue inputs have the addresses C and D



When two columns are linked to each other, the analogue outputs A and B of column no. 1 are connected to the analogue inputs C and D of the column no. 2. Mixing of several columns is always possible.

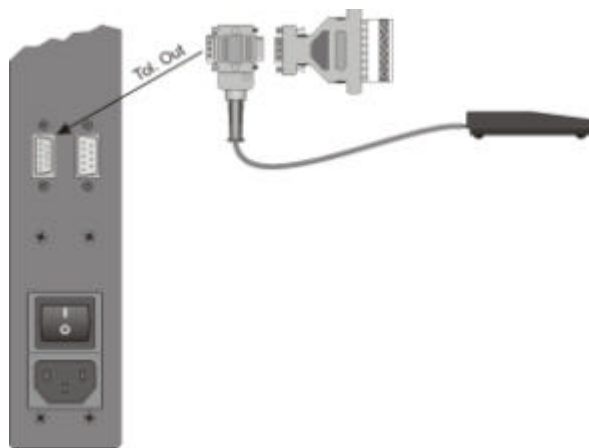
Adapter **CA2** S40040521

For more information to the CA2 adapter see chapter 6.2

2.6 Connect foot or hand switch

Foot and hand switches can be connected to the Tol.Out socket, to be found at the rear of the column. Please, use only the foot and hand switches supplied with the device. When a foot or hand switch with an adapter-connector is used, it is possible to also connect an adapter to the Tol.-Out connectors.

The functions of the foot switch or viceversa hand switch can be set in the setup menu.



Foot and hand switch types :	TESA-No.
Foot switch IP32.....	S40040024
Foot switch IP65	S40040025
Hand switch IP65.....	

Caution !!!
Secure the screws on all connections.

For the pin assignment of the connector, see chapter 6

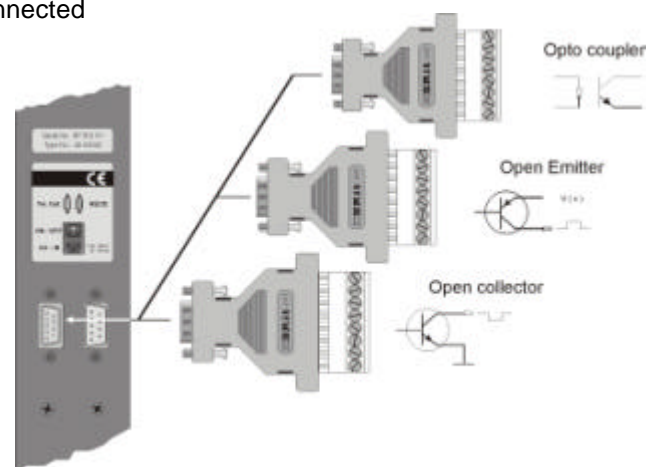
2.7 Connecting adapters for tolerance outputs

Adapters for switching outputs of tolerances are connected on the rear to the "Tol. Out". Sub-D-socket.

A total of 5 switching outputs are available :

1. Beyond max. tolerance (red)
2. Beyond max. tolerance (yellow)
3. Measured value within range (green)
4. Beyond min. tolerance (yellow)
5. Beyond min. tolerance (red)

Adapters for tolerance outputs :	TESA No.
Open collector-adapter OC3	S40040021
Open emitter-adapter OE3	S40040022
Opto coupler-adapter OP3	S40040520



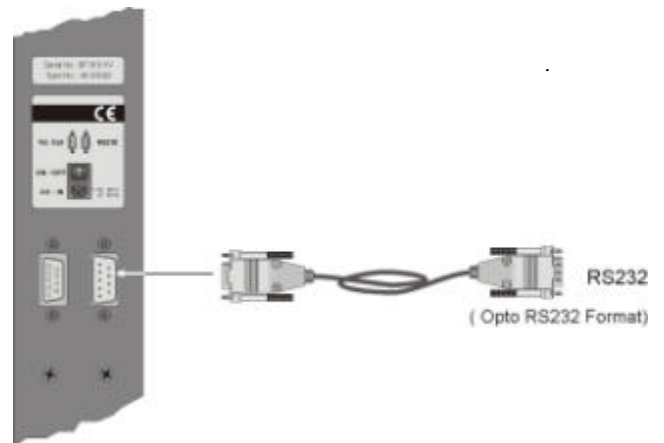
For pin assignment of adapter OC/OE/OP3, see chapter 6.2



2.8 Connection a PC or TESA PRINTER SPC

To connect a PC (COM 1...4) res. the TESA PRINTER SPC use the "RS232" Sub-D connector at the rear of the column.

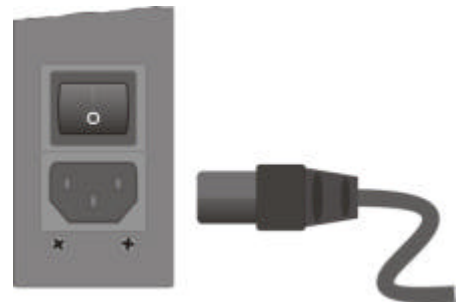
For pin assignment see chapter 6



RS232 cable Connecting cable TT300 / EL300 – PC or TESA PRINTER SPC 9p m / 9p f04761052

2.9 Connection to the power supply

Make sure first that the rated voltage complies with the electrical requirements indicated on the labels at the rear of the instrument. If they do, connect the power cable to the rear of the column.



Caution !!! The column may be connected to the power supply only via a properly grounded safety socket.

2.10 Power on / Self test

Every time the column is switched on the numeric display shows the different software versions (**AL** - Assembling Routines, **HL** - High-Level Routines). A self test is then run automatically in order to check the single system components.

If an error is detected during a test route, an error message appears on the numeric display. The self test takes approximately 15 seconds.

During self test all displays are activated one after the other so that the person executing the test may check the display.

During the self test the RS232 interface of the column remains inactive.



3. Programming the column gauge

All programmings and settings of the column gauge are done with the 4 front panel keys. The user is taken step by step through the different menus with the help of the light fields and the numeric display. The programming follows a logic structure and becomes self-explanatory after a short study.

3.1 Key functions

PRG/CAL When this key is pressed the gauge changes from measurement to Programming mode or viceversa.

ENTER On **Measuring mode** this key starts or finishes a dynamic measurement. In Programming mode, this key confirms the programmed values and selections.

↑ When this key is pressed in **Measuring mode** the measurement value on the numeric display is incremented. A short pressure increments by 1. If the key is held down the measurement is incremented continuously with increasing speed (manual zero adjustment).
In **Programming mode** the key is used to increase a given value or switch to the next function.

↓ When this key is pressed in **Measuring mode** the measurement value on the numeric display is decremented. A short pressure decrements by 1 unit. If the key is held down the measurement value is decremented continuously with increasing speed (manual zero adjustment).
In **Programming mode** the key is used to reduce a given value or to switch to the next function.

↑ & ↓ When the **↑** and **↓**- keys are pressed simultaneously in **Measuring mode** either an automatic zero adjustment or a gauge calibration is done.
If the **↑** and **↓** keys are pressed simultaneously for more than 3 seconds the internal zero adjustment offset value is erased, so enabling the mechanical adjustment of inductive probes (refer to 'Mechanical adjustment of inductive probes').

3.2 Foot switch functions

1. Start / Stop dynamic measurements
2. Output of measured value at RS232 output
3. Display control : **trAnS** ® transfer of measured value to display
hold ® hold display value
4. Automatic zero adjustment or gauge calibration.

Notice : The functions 2 ... 4 can be switched on and off in the setup menu.



3.3 Kurzanleitung für eilige Programmierer

Menu selection and programming

1. Use the **PRG/CAL** key to toggle from Measurement mode to Programming mode and viceversa.
2. In Programming mode the adjustable element is flashing.
3. The flashing element can be modified with the **↑** oder **↓** keys (+1, -1 or move to the next display field).
4. Press the **ENTER** key to confirm a flashing setting.

Menu-Overview

Input of	Numeric display	Input or selection ...
Measuring mode	→ <input type="text" value="Set.OP"/>	Manual selection Automatic selection
Gauge selection	→ <input type="text" value="GAUGE"/>	Gauge 1...4 & Setup
Unit	→ <input type="text" value="Unit"/>	mm inch
Master value(s)	→ <input type="text" value="Preset"/>	Master value for zero adjustment Master value for gauge calibration

Programming the column display

Nominal value	→ <input type="text" value="Set.Pnt"/>	Zero point of column display
Tolerances	→ <input type="text" value="Set.tol."/>	Tolerance limits 1...4 as deviation from nominal value
Probe connections	→ <input type="text" value="A – D"/>	Coefficients and mixing of probes A....D
Return	→ <input type="text" value="rEturn"/>	Return to gauge & SetUp selection

- a. Resolution (**1µm / 0.1µm or 0.0001 inch / 0.00001 inch**)
- b. Column (**AUTO, ± 1,5mm to ± 50µm or 0.1500 inch ... 0.0005 inch**)
- c. Controlling of display output by foot switch (**OFF**)
- d. Automatic zero adjustment (using keypad **On /OFF**, using foot switch **On/OFF**)
- e. Serial data transfer **SoC On/OFF** - continuous / **Sot On/OFF** - foot switch
- f. Automatic gauge calibration (**On/OFF**)
- g. Column display mode (**StAndA** - from bottom, **CentrE** - from center, **toP** - from top)
- h. Tolerance marks display **FLASH** - Tolerance marks flash when measured value is out of tolerance
- i. Password to secure programming (6-digit number)
- j. Filter time value (**OFF**, 1 = 10msec, ... 6 = 1sec.)

For help during programming use the programming reference card !!!

The card will provide you more information and should be your true helper at operation.

First-time users of the column gauge should carefully read through the instructions given in the following chapter, which deals extensively with the different program steps.

Users with a basic knowledge should use the following chapter then reference.

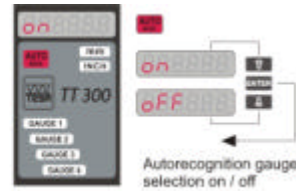


3.4 Programming menu

Press the **PRG/CAL** key to switch from Measuring to Programming mode.
 - 'SEt OP.' flashes on the numeric display..



← ENTER →



Selecting Operating Mode
 (Manual or automatic gauge switching)

Automatic gauge switching on/off

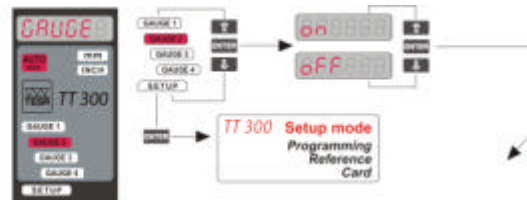
The programming of the column gauge starts with the selection of the operating mode.

Manual gauge switching
Automatic gauge switching

Press the **ENTER** key to quit 'SEt OP.' The light field **AUTO Mode** lights up and **on** or **oFF** flashes on the numeric display.
 Use the **↑** and **↓** keys to enable (on) or disable (oFF) automatic gauge switching. Confirm your choice by pressing the **ENTER** key.



← ENTER →



2. Select gauge 1 ... 4 and Setup

Programming card

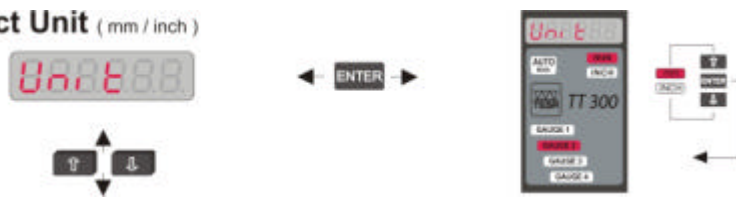
In this menu you can switch on or off the gauges 1...4 and access both Programming mode for the gauges 1...4 and the SetUP menu.

Press the **↑** and **↓** keys to select the gauges 1...4 and the SetUP menu. In the light fields of Programming mode the number of the selected gauge flashes while the numeric display indicates whether the gauge is switched on or off. The relevant gauge or the SetUP menu can be chosen by pressing the ENTER key.
 As soon as a gauge is chosen (on), programming of the gauge for the unit starts immediately.

Notice : If all gauges are switched off the error message 'Err 7' appears on the numeric display as measurement operation is not possible.



1. Select Unit (mm / inch)



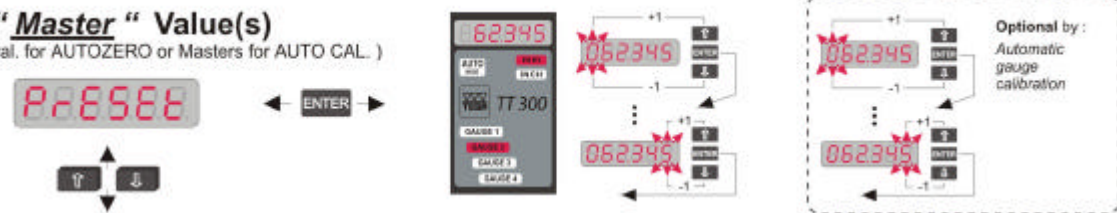
Once in the 3rd menu press the **ENTER** key and select either „mm“ or „INCH“ by pressing the **↑** or **↓**, key, then confirm with **ENTER** key.

Press the **↓** key to advance to the next menu.

Notice : a) If you change the unit, numeric values introduced in the program, eg. master values, zero point values and tolerances do not change automatically..

2. Set "Master" Value(s)

(Preset val. for AUTOZERO or Masters for AUTO CAL.)



The programming of a master value is base of the automatic zero adjustment.

On autozero adjustment (do this by placing the master piece under the probe and press the **↑** and **↓** keys simultaneously during Measuring mode) the master value will be taken as the measured value.

When measuring relative values (shows the deviation to the nominal value) zero is programmed as master value.

When pneumatic converters are used, automatic gauge calibration can be considered as an option. If this option is chosen in the setup menu "**AutoCA**" you will be prompted to introduce a second master value.

If you then enter the same value for both masters, the error message '**Err. 11**' will appear. Should the difference between the two masters be more than 3 mm the error message '**Err 12**' will appear.

Notice : When Autozero is enabled, the zero point of the column display is set by introducing an offset value related to the master.

When automatic gauge calibration is enabled, the offset value (zero point) is set and, at the same time, the gain (pneumatic spread) is executed automatically.



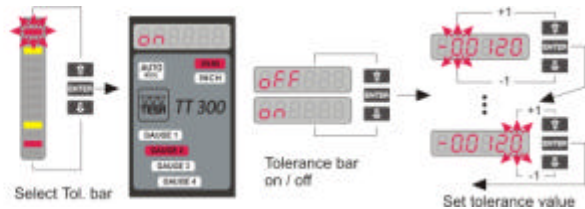
3. Set Nominal Size
(Zero point of column display)



The nominal value indicates the value to be chosen as zero point of the column display. If the nominal value is 20 mm (SEt.Pnt. is set to 20 mm) the column display will show a deviation of 0,1 mm for a workpiece measuring of 20,1 mm.

Notice : The nominal value is used only for the zero position of the column display and does not influence the numeric display.

4. Programme Tolerances



In this menu you can set a maximum of 4 tolerance marks representing relative deviation from the nominal value.

Programming starts by selecting one of the tolerance marks. To this aim the column displays the 4 tolerance marks :

- + **red** upper tolerance (red)
- + **yellow** upper tolerance (yellow)
- **yellow** lower tolerance (yellow)
- **red** lower tolerance (red)

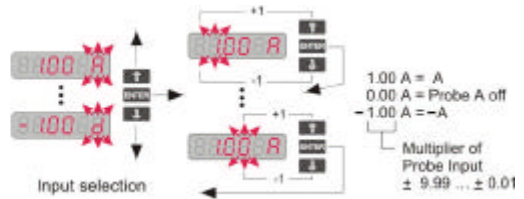
The chosen tolerance mark flashes. Go to the next mark using the **↑** and **↓** keys and confirm with **ENTER** key. After this you can switch the tolerance mark on or off by selecting **on/off** the numeric display. You can set the relative deviation from the nominal value (max. ± 1.5 mm) if the tolerance mark is switched on.



5. Probe Mixing
(Formular for the Gauge)



← ENTER →



In this menu the inductive probe inputs or voltage inputs A...D are assigned to the gauge (or gauges). Any combination of the inputs (i.e. A + B, A - B, A+B - C+D, ...) is possible.

Besides, you can apply a fixture coefficient (multiplier ranging 0,01 to 9,99) to each input.

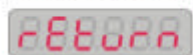
- Example :
- | | | | | | |
|----------|---|---------|-------------------|---|----------|
| a) A + B | Ⓡ | 1.00 A | c) <u>A - C</u> | Ⓡ | 0.50 A |
| | | 1.00 B | | | 2 |
| | | 0.00 C | | | 0.00 B |
| | | 0.00 D | | | - 0.50 C |
| | | | | | 0.00 D |
| | | | | | |
| b) A - B | Ⓡ | 1.00 A | d) A+2B- <u>C</u> | Ⓡ | 1.00 A |
| | | -1.00 B | | | 2 |
| | | 0.00 C | | | 0.00 B |
| | | 0.00 D | | | - 0.50 C |
| | | | | | 0.00 D |

Notice : When all probe inputs are disabled (0.00 A...D) measurements are no longer possible and the error message 'Err. 1' appears on the numeric display.

If an inductive probe or an analogue input (A...D) has been assigned to more than one gauges and the "Auto mode" (automatic recognition) is on of the numeric display "Err 8" will appear.

As this input simultaneously changes the measurement value of more the one gauges, automatic recognition of (only one) active gauge is no longer possible.

6. Return from Gauge Programming



← ENTER →

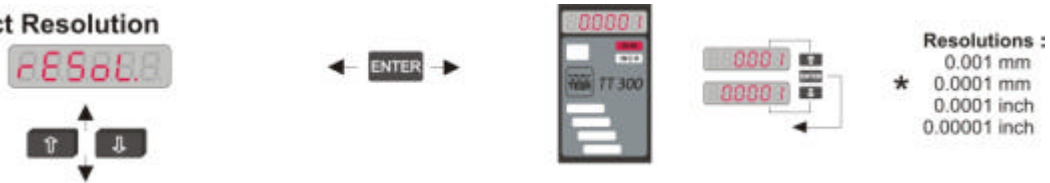
Return to [2. Select Gauge 1 ... 4 & Setup]



3.5 Base settings / Setup menu

The setup menu („**SETUP**“) contains all base settings which are usually introduced only at first working. *The base factory settings are marked by * throughout the menus.*

1. Select Resolution



rESoL. In this menu you can select the resolution of the numeric display for the measurement mode.
 0.001 mm or 0.0001 INCH (low resolution)
 0.0001 mm or 0.00001 INCH (high resolution)

Notice : When a new resolution is set, only the decimal point is shifted.
 The numeric values set in the program, eg master values and tolerances) may require some adjustment.

2. Select Column Range

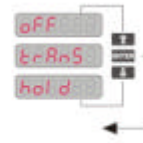


rAnGE In this menu you can set the column display range. You can select a fixed range ± 1.5 mm to ± 50 μ m or ± 0.15 INCH to $\pm 0,0005$ INCH or the **Auto** option for automatic range selection. In automatic mode the column gauge selects automatically the optimum column display range for the selected tolerance.

- AUTO** - Automatic selection of column display range
- 1.5000** - Select fixed column display range ± 1.5 mm
- ...
- 0.0050** - Select fixed column display range ± 50 μ m



3. Display Control by Trigger



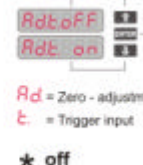
- Display Control :
- * **oFF** - Continuous update of display
 - trans** - Display update only by trigger
 - hold** - Display hold by trigger

triGG. In this menu you can chose to control the numeric and column displays via the foot switch.

- oFF** - Continuous display update with measurements
The foot switch does not effect this display output.
- trAnS** - By pressing the foot switch you start a measurement cycle with transfer to the displays.
- hold** - When the foot switch is pressed the display output is on hold (display frozen).

Notice : If the options "Dyn. measurement" or "Manual gauge selection" are enabled, the functions "trAnS" and "hold" are no longer available because the foot switch is needed to start/stop dynamic measurement or for gauge switching.
Error messages 'Err. 3' appears on the numeric display.

4. Auto Zero by Trigger



Rd = Zero - adjustment
t = Trigger input
* **oFF**

Rd = Zero - adjustr
b = Keyboard
* **on**

0-triG. Automatic zero adjustment or automatic gauge calibration with the **↑** and **↓** keys or with foot switch enabled or disabled.

- Adt.** oFF/on Zero adjustment / gauge calibration by foot switch
- oFF** - Disable
 - on** - Enable
- Adb.** oFF/on Zero adjustment / gauge calibration from the keyboard.
- oFF** - Disable
 - on** - Enable

Notice : If "Dyn. measurement" or "Manual gauge selection" are enabled, the function "0-triG" is no longer available, because the foot switch is needed to Start/Stop dynamic measurement or gauge switching.
The error message 'Err. 2' appears on the numeric display.



5. Serial Output (continuous, triggered)



rS 232 In this menu the data output via RS232 interface is programmed.

- So.C.** oFF/on Set continuous data output
oFF - Continuous data output is disabled
on - Continuous data output is enabled

Notice : The continuous data output is generally done only in conjunction with the RSA adapter (output of the measurement value from the numeric display, then analogue voltage).

- So.t.** oFF/on Programming RS232 for data output triggered by foot switch
oFF - No data output
on - Current measurement value transmitted by foot switch

6. Automatic gauge calibration



AutoCA This menu contains the options "**Automatic zero adjustment**" using one master, and "**Automatic gauge calibration**" using two masters.

- on** - Automatic gauge calibration with 2 masters is on.
oFF - Automatic zero adjustment with 1 master is on.

Notice : In Programming mode, select the "PrESEt" menu and make sure that the master selected for zero adjustment as well as the master values selected for gauge calibration are correct.

7. Column display mode



Col.di S. In this menu zero point of column display is set.

- StAndA.** - Column moves from bottom to top
CEntrE - Column moves from the centre to top or to bottom
toP - Column moves from top to bottom



8. Tolerance marks



★ Flash - Tol.-marks are flashing if mea.-value is out of tolerance
 Lit - Flashing of Tol.-marks is disabled

tol.LEd In this menu flashing of tolerance marks when measurement values is out of tolerance is enabled or disabled.

Flash = The tolerance marks flash if measurement value is out of the green scale.

Lit = Tolerance marks do not flash.

9. Password (secure Programming Mode)



PASS.Cd. For protection of program settings in this menu you can set a password option on or off. If the password option has been set to "on" the numeric display asks the operator to input a password consisting of a 6-digit number.

Notice : If the programming menu is loaded later on by the **PRG/CAL** key the column display will prompt you to introduce the 6-digit password. (If you have forgotten the password, you can nevertheless access the programming menu with the password **240355**).

10. Digital Filter



Filter time values :
 ★ off - filter off
 1 - 10 msec.
 2 - 100 msec.
 3 - 200 msec.
 4 - 400 msec.
 5 - 600 msec.
 6 - 1 sec.

FiLEr In this menu you can select a digital filter for the reading.

oFF - Digital filter is off.

1...6 - Filter levels

Notice : For normal measurements the filter time constant should be set to 1 or 2. Higher filter values are necessary only for special applications.



Error	Error description	Error correction
Err. 3	The function of the foot switch connector (trigger input) is already reserved for the function Start/Stop dynamic measurements and manual gauge selection. Additional control of display functions (trAns and hold) with help of the foot switch is not allowed.	Enter Programming mode by pressing ' PRG/CAL ' key. Move to setup menu " Display by Trigger " and select "oFF"
Err. 7	All gauges are switched off.	Introduce a gauge (refer to chapter 3)
Err. 8	Automatic gauge switching is enabled (AUTO mode = on). An inductive probe or an analogue input (A ... D) has been assigned to more than one gauges. As this input simultaneously changes the measurement value of more than one gauges, automatic recognition of (only one) active gauge is no longer possible.	There are two possibilities of error correction : 1. Press ' PRG/CAL ' key to enter Programming mode, set automatic gauge selection to off (AUTO=OFF in the " SEt OP. ") Gauge selection is then performed manually. 2. Press ' PRG/CAL ' key to enter Programming mode, move to " Probe mixing " menu and assign each input (A,...,D) only to one gauge.
Err. 10	During automatic gauge calibration the same master was applied twice.	Recalibrate with 2 different masters.
Err. 11	The same value, or a difference smaller than 6 digits was entered for both masters.	Press ' PRG/CAL ' key to enter Programming mode. Choose menu " Set master " and introduce 2 masters with a difference >6 digits.
Err. 12	The difference between the 2 programmed masters is too big (difference > 3.0 mm)	Press ' PRG/CAL ' key to enter Programming mode. Choose menu " Set master " and introduce 2 masters with a difference <3 mm.
Err. 13	Error during automatic gauge calibration. The calibration factor is too low.	The difference between the programmed masters is much bigger than the difference between the measured master values. Recalibrate and check the programmed masters values. Press ' PRG/CAL ' key enter the programming mode and check the master values in the master input menu " PrESEt ".
Err. 14	Error during automatic gauge calibration. The calibration factor is too high.	The difference between the programmed masters is much smaller than the difference between the measured master values ditto Err. 13

2. System Error

In case of hardware problems system errors are indicated on the numeric display by **SYSEr.n** (n = 1...4). Error messages are intended to help our service department to quickly analyse the reasons of your difficulties. Please, press **<ENTER>**- to restart the column gauge or turn the column off and on again.

If the error message reappears, contact the TESA Service department.



4. Working with the column gauge

4.1 Getting started :

- ◆ Start by mounting the footplate and connecting the accessories (inductive probes, foot switches, etc.). Follow the instructions given in chapter 2 of this manual.
- ◆ The next step will be programming of the column gauge for your application. Follow the instructions given in chapter 3 of this manual.
To do this go through all menus listed in these chapter or in the programming card.
- ◆ After this, use the master and adjust mechanically the probes in the fixture.
Refer to chapter 4.3
- ◆ **Calibrating the column display** - Refer to chapter 4.6.
*Notice : The column gauge is calibrated at the factory for the specified inductive probes.
Recalibration by the user will only be necessary under exceptional circumstances, eg when using uncalibrated probes or extension cables.*
- ◆ The column gauge is now ready for work.

4.2 Measurement operation :

- Before starting work you should always perform an **automatic zero adjustment** using the master supplied in order to compensate all offset errors caused by fluctuations in temperature, wear and so on.
Refer to chapter 4.4.
- When working with pneumatic converters or in case of special applications requiring two masters, instead of the automatic zero adjustment an **automatic gauge calibration** will take place.
Refer to chapter 4.5
The automatic gauge calibration corrects of all offset and spread errors.
Switching between the "**Automatic zero adjustment**" and the "**Automatic gauge calibration**" is done in the setup menu "**AutoCA**".

4.3 Mechanical adjustment of inductive probes

Inductive probes reach their greatest accuracy only within a comparatively small working range. It is therefore extremely important to adjust them very carefully.

1. Correct for mechanical adjustment only one inductive probe at a time.
2. The column gauge must be in Operating mode. If not, press the **PRG/CAL** key to quit the Programming mode.
3. Press the **↑** and **↓** keys for more than 3 seconds until the luminous displays **MIN**, **MAX**, **TIR** and **MEAN** start flashing and quit the Adjustment mode. When this mode is active the column gauge switches all factors and offsets automatically off and displays the absolute measured value of the inductive probe connected with no distortions.
4. The column display automatically switches to the range $\pm 150 \mu\text{m}$ / 15 Thou output range and sets two orientative tolerance marks at $\pm 50 \mu\text{m}$ / ± 6 Thou.
5. Adjust now the inductive probe placed on the master in its mechanical zero point. If the reading showed by the column display is in the green interval ($\pm 50 \mu\text{m}$ / ± 6 Thou), the adjustment of the inductive probe is, as a rule, considered accurate enough.
6. Disconnect the probe and connect the next probe to be adjusted.
7. When all probes have been adjusted, press the **ENTER** key to exit the Adjustment mode. The command **Load** appears in the numeric display and coefficients of the inputs are loaded once again. The offset values cannot be retrieved. It is therefore necessary to perform a zero adjustment or a gauge calibration before starting work.



4.4 Zero adjustment of gauges

Start by placing the master in the fixture. Make sure that the column gauge is in measurement mode. If necessary press the **PRG/CAL** key to exit the Programming mode. The setup menu **AutoCA** must be set to **OFF** in order to perform the automatic zero adjustment.

Automatic zero adjustment :

Press the **↑** and **↓** keys simultaneously to trigger an automatic zero adjustment of the column gauge. The programmed master value ("**PrESet**" menu) appears on the numeric display.

The message "**SECURE**" in the numeric display indicates that the keypad is locked. Refer to the SETUP menu. "Automatic adjustment" ("**0-triG**" ® **Adb.** on/oFF set to "**on**").

Automatic zero adjustment can also be triggered by a foot switch or via an external contact under the condition that "Automatic adjustment" is enabled in the setup menu ("**0-triG**" ® **Adt.** on/oFF set to "**on**").

Manual zero adjustment :

The measurement value can be increased or decreased by one digit by pressing the **↑** or **↓** key. If one of the arrow keys is held down the measurement value grows or decreases continuously at an increasing speed. If "**SECURE**" appears in the numeric display refer to setup menu "Automatic adjustment" ("**0-triG**" ® **Adb.** on/oFF set to "**on**").

Zero adjustment in dynamic measurement mode :

First perform a dynamic measurement of the masterpiece. *Refer to chapter 4.7*

After completion press the **↑** and **↓** keys simultaneously to trigger an automatic zero adjustment. The column gauge calculates the necessary offset on the basis of the programmed master and of the previous measured masterpiece.

Example : Press the ENTER key to start the dynamic measurement. For example wave a bore gauge inside a bore (measure Min.-value). Press the ENTER key to finish the dynamic measurement mode. Press **↑** and **↓** key simultaneously for automatic zero adjustment.

4.5 Automatic gauge calibration

Start by placing one of the two masters in the measuring fixture (plug, ring, ...) and make sure that the column gauge is in measurement mode. If not, press **PRG/CAL** key to exit the Programming mode. The setup menu **AutoCA** must be set to **ON** in order to perform the automatic gauge calibration.

Automatic calibration is started by pressing the **↑** and **↓** keys simultaneously. In the numeric display the message '**CAL.**' and the **Measured value** flash alternately.

Place now the 2nd master in the measuring fixture and press the **↑** and **↓** keys again. The column gauge will now carry out the calibration automatically and takes the second master value in the display.

"**SECURE**" at the numeric display indicates that the keypad is locked. Refer to the SETUP menu for "Automatic adjustment " ("**0-triG**" ® **Adb.** on/oFF must be set to "**on**").

Automatic gauge calibration can also be triggered by the foot switch or via an external contact, under condition that "Automatic adjustment" is enabled in the setup menu ("**0-triG**" ® **Adt.** on/oFF set to "**on**").



4.6 Calibrating probe inputs

The probe inputs on the **B/C100-ind2(4)** measurement modules can be calibrated using potentiometers. The potentiometers are placed beside the probe input sockets and can be accessed from the outside.

Before starting calibration, change to Programming mode and select the input you wish to calibrate (A, ...D) in the "**Probe mixing**" menu. The input should be assigned the multiplier 1 and all other inputs should be disabled (multiplier 0). Press **PRG/CAL** key to exit Programming mode and press the **↑** and **↓** keys simultaneously for more than 3 seconds until the luminous displays **MIN**, **MAX**, **TIR** and **MEAN** start flashing.

During this operation the column gauge erases all offset and gauge calibration values. Press the **ENTER**-key to quit. The column gauge is now again in Measuring mode and can be calibrated using 2 masters (Master pieces, Cal.-dongel, ...). During the calibration the 2 masters are placed alternately in the measuring fixture and the difference between the 2 measured values is calculated. Use the relevant potentiometer to adjust the gain until the measured and the real differences are the same.



5. RS232 interface

The column gauge has an RS232 interface to support data output to computers, statistic printers and so on. The plug connector (9-pin Sub-D) is mounted at the rear of the column gauge and is marked **RS232**. Data transmission and data format according to **Opto RS232**

RS232 cable Connecting cable TT300 / EL300 – PC or TESA PRINTER SPC 9p m / 9p f04761052

5.1 Transmission format

Baud rate : 4800
 Start bits : 1
 Data bits : 7
 Parity : EVEN
 Stop bits : 2

5.2 Data format

The data format has a fixed length of 10 digits including the end character <cr> = ASCII 13. The measured value always starts with a sign (+/-) followed by leading zeroes. The decimal point is shifted according to the unit and the resolution chosen.

Unit	Resolution	Data format
mm	0.0001 mm	"± 012.3456 <cr>"
mm	0.001 mm	"±0123.456 <cr>"
inch	0.00001 inch	"±01.23456 <cr>"
inch	0.0001 inch	"±012.3456 <cr>"

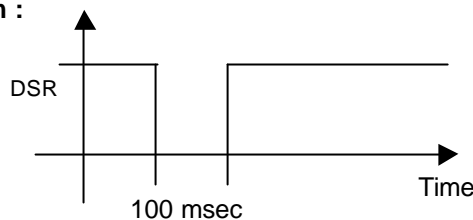
When the measurement values are out of range "OR <cr>" is sent to the output device by the column gauge.

5.3 Data request

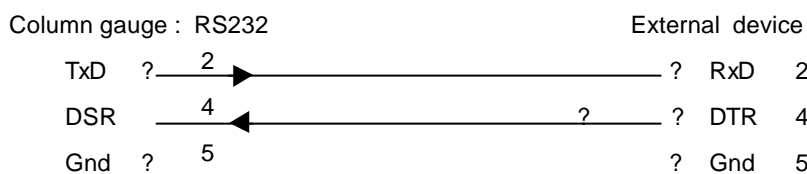
The column gauge supports both data request variants of the Opto RS232 interface.

1. Data request via handshake lines (unidirectional Opto RS 232)

Impulse diagram :



Connection wirings





Example : PC Program (DOS, BASIC)

```

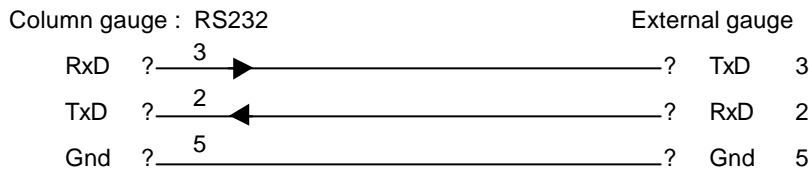
100 REM DATA REQUEST WITH DTR-LINE
110 OPEN "COM1,4800,E,7,2" FOR RANDOM AS #1
120 OUT &H03FC,&H000A
... COM device open
... DTR line reset
... (COM1=3FC / COM2=2FC / COM3=3EC / COM4=2EC)

130 DELAY 0.1
140 OUT &H03FC,&H000B
... 100 msec wait time
... DTR line set

150 INPUT #1,A$
... measurement value input
160 PRINT A$
... measurement value display
170 CLOSE #1
... COM device close
180 END
    
```

2. Data request by Request String "?" <cr> (Bi-directional Opto RS232)

The external device (PC, statistic printer, multiplexer...) sends a "?", <cr> to the column gauge to request data.



Example : PC-Program (DOS, BASIC)

```

100 REM REQUEST MEASUREMENT VALUE BY "?"
110 OPEN "COM1,4800,E,7,2" FOR RANDOM AS #1
120 PRINT#1, "?" +CHR$(13)
130 INPUT #1,A$
140 PRINT A$
150 CLOSE #1
160 END
... COM device open
... Request measurement value
... Input measurement value
... Display measurement value
... COM device close
    
```

5.4 Transfer of measurement values

The "SetUP" menu "Serial data output" allows 2 different settings for data transfer.

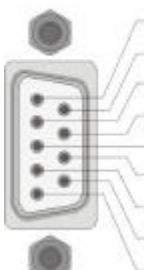
1. Data transfer can be triggered by pressing either the foot or the hand switch or via an external contact.
2. Continuous data transfer from the column gauge.
Refer to chapter 3.5



6. Pin assignments of male connectors

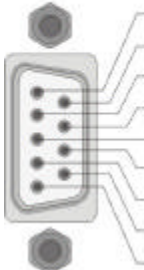
6.1 Connectors of the column gauge

RS232 **PC Side**

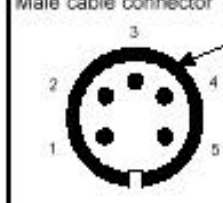
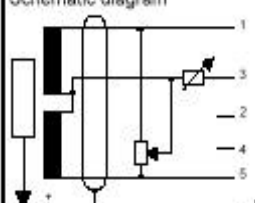
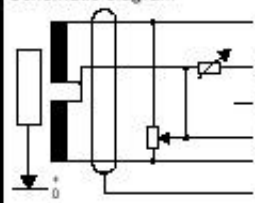


1 - n.c.	DSR	6
6 - DTR (Output)	RxD	2
2 - TxD (Output)	RTS	7
7 - n.c.	TxD	3
3 - RxD (Input)	CTS	8
8 - RTS (Output)	DTR	4
4 - DSR (Input)	GND	5
9 - n.c.		
5 - GND (Masse)		

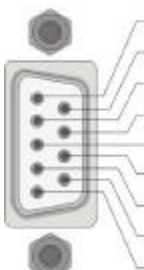
Tol. Out



1 - TRIG (Input)	Internal Pull Up - Resistor 1kΩ to +5V
6 - n.c.	
2 - n.c.	
7 - n.c.	
3 - CLK	Signal for OC / OE & OP3 - Adapter
8 - n.c.	
4 - DATA	Signal for OC / OE & OP3 - Adapter
9 - VCC (+5V, I _{max} = 20mA)	Available for external supply
5 - GND (Ground)	

Probe Inputs:	TESA TT 300	MERCER EL 300
<p>Fiche de câble Stecker, männlich Male cable connector</p>  <p>DIN 45322, sans aîrre without pin 6</p>	<p>Schéma de principe Prinzipschema Schematic diagram</p> 	<p>Schéma de principe Prinzipschema Schematic diagram</p> 

Analogue IN - OUT - ind 2



1 - Analogue OUT Probe A	$U_{out} = \pm 1.5V / mm, Imp. > 5k\Omega$
6 - Analogue - Ground (Gnd)	
2 - Analogue OUT Probe B	$U_{out} = \pm 1.5V / mm, Imp. > 5k\Omega$
7 - Analogue - Ground (Gnd)	
3 - Analogue IN C	$U_{in} = \pm 1.5V / mm, R_{in} = 1M\Omega$
8 - Analogue - Ground (Gnd)	
4 - Analogue IN D	$U_{in} = \pm 1.5V / mm, R_{in} = 1M\Omega$
9 - VCC (+5V, I _{max} = 20mA)	Available for external supply
5 - Analogue - Ground (Gnd)	



6.2 Plug-in terminal blocks for accessories

CA2 - Adapter TESA No. S40040521

Trimmer of input C

Trimmer of input D

- Shield (Cable shield)
- Out A (Voltage output A = 1.5V / mm , Imp. > 5kΩ)
- Out B (Voltage output B = 1.5V / mm , Imp. > 5kΩ)
- Inp C (Voltage input C = 1.5V / mm , Ri > 18kΩ)
- Inp D (Voltage input D = 1.5V / mm , Ri > 18kΩ)
- Gnd (Ground)

OE3 - Adapter TESA No. S40040021

CLK 3
DATA 4
Gnd 5
Vcc 9

Q1
...
Q5
V(+)
Gnd
Vcc

- Q1 (Upper Tol. red)
- Q2 (Upper Tol. yellow)
- Q3 (Inside Tol. green)
- Q4 (Lower Tol. yellow)
- Q5 (Lower Tol. red)
- V(+) (Ext. Voltage)
- Gnd (Ground)
- Vcc (+5V , I_{max} = 20mA)

Technical Data :
Max. allowed voltage at Q1 ... Q5 = 40V
Max. allowed output current at Q1 ... Q5 = 100mA

OC3 - Adapter TESA No. S40040022

CLK 3
DATA 4
Gnd 5
Vcc 9

Q1
...
Q5
V(+)
Gnd
Vcc

- Q1 (Upper Tol. red)
- Q2 (Upper Tol. yellow)
- Q3 (Inside Tol. green)
- Q4 (Lower Tol. yellow)
- Q5 (Lower Tol. red)
- V(+) (Ext. voltage)
- Gnd (Ground)
- Vcc (+5V , I_{max} = 20mA)

Technical Data :
Max. allowed voltage at Q1 ... Q5 = 42V
Max. allowed input current at Q1 ... Q5 = 350mA

OP3 - Adapter TESA No. S40040520

Vcc 9
CLK 3
DATA 4
Gnd 5
TRIG 1

Q1
...
Q5
Ext. Gnd
TRIG (-)
TRIG (+)

- Q1 (Upper Tol. red)
- Q2 (Upper Tol. yellow)
- Q3 (Inside Tol. green)
- Q4 (Lower Tol. yellow)
- Q5 (Lower Tol. red)
- Ext. Gnd (ext. Ground)
- TRIG (-) (Trigger in (-))
- TRIG (+) (Trigger in (+))

Technical Data :
Isolation voltage : 2500V
Max. allowed voltage at Q1 ... Q5 = 35V
Max. allowed current at Q1 ... Q5 = 20mA

Input TRIG(-) , TRIG(+): U_N = 5 ... 25V
I_{IN} = 9.6 ... 15mA



7. Accessories

Designation	TESA-Number
<p>TT300</p> <p>Electronic Measuring Instruments for TESA compatible probe Multi gauging – Mode 6digit numeric display, 100 bar column measurement module (3 colours) LED's for unit, range and function display, RS232, trigger input digital outputs, switching power supply for .85...260V, incl. footplate and manual.</p> <p>- Execution with 2 TESA inductive probe inputs, and 04030012 2 analogous inputs and outputs</p> <p>- Execution with 4 TESA inductive probe inputs 04030014</p>	
<p>EL300</p> <p>Electronic Measuring Instruments for MERCER compatible probe Multi gauging - Mode 6digit numeric display, 100 bar column measurement module (3 colours) LED's for unit, range and function display, RS232, trigger input digital outputs, switching power supply for .85...260V, incl. footplate and manual.</p> <p>- Execution with 2 MERCER inductive probe inputs, and 04036012 2 analogous inputs and outputs</p> <p>- Execution with 4 MERCER inductive probe inputs 04036014</p>	
<p>CA2</p> <p>Gauge to gauge connection adapter with terminal block for 2 outputs and 2 inputs with adjustment S40040521</p>	
<p>RS232 cable</p> <p>Connection cable TT300/EL300 – PC or TESA PRINTER SPC 9p m / 9p f 04761052</p>	
<p>Foot switch</p> <p>Foot switch IP32 S40040024 Foot switch IP65 S40040025</p>	
<p>Hand switch</p> <p>Hand switch IP65 S40040023</p>	
<p>OC3</p> <p>Open collector adapter with plug-in terminal block (Low Level) S40040021</p>	
<p>OE3</p> <p>Open emitter-adapter with plug-in terminal block (High Level) S40040022</p>	
<p>OP3</p> <p>Opto coupler adapter with plug-in terminal block S40040520</p>	



8. Safety instructions

The present device is state-of-the-art design and complies with the current safety standards. It is nevertheless mandatory to observe the following instructions in order to prevent personal injuries or accidental death of staffmembers and other persons.

1. All operators must read the present instructions and this manual very carefully **before starting operation**.
2. The device may be used only when **in errorless technical condition**. Disruptions which may jeopardise operational safety must be addressed immediately.
3. The device may be used only as stated in these instructions. The manual must be kept near at hand at the place of operation.
4. Before connecting the device to the power outlet, make sure that the voltage indicated on the label corresponds to the voltage of the local power net. If this is not the case, the device shall under no circumstances be connected to the power outlet.
5. The device must be connected to the power supply through a properly grounded safety socket. Extension cables, where required, must comply with the VDE safety standards.
6. Any modification and procedures concerning the device are permitted only with the prior written consent of Brown & Sharpe TESA SA and must be carried out by competent staff. Opening the case or tampering with the device without prior permission will lead to the loss of the guarantee and free the producer from all liabilities. Before opening the device, make sure to effectively interrupt the power supply, eg. by disconnecting the power cable.
7. Before cleaning, disconnect the device from the power supply. No liquids should ever be allowed to leak inside the gauge. Strictly avoid the use of cleaners attacking plastic.
8. Replace faulty fuses only with fuses of identical amperage and current characteristics following the instructions given in this manual.
9. Corporate guidelines and safety regulations enforced by the industrial trade associations for the prevention of industrial accidents must be strictly observed. Make sure to consult the security officer at your company.
10. Do not operate the device in an environment containing explosive gases, as an electric spark may cause an explosion.

We reserve for us the right to change the design and technical data contained in our documentation without notifying our customers. Brown & Sharpe TESA is not obliged to notify changes to the products to earlier buyers.

No parts of this document may be reproduced without written permission from Brown & Sharpe TESA.



9. Declaration of conformity

We thank you very much for your confidence in purchasing this product. We hereby certify that it was inspected.

We declare under our sole responsibility that this product is in conformity with standards and technical data as specified in our sales documents (instruction manual, leaflet, catalogue).

In addition, we certify that the measuring equipment used to check this product refers to national master standards.

10. Guarantee

We guarantee this instrument against any fault of design, manufacture or material for a period of 12 months from the date of purchase. Any repair work carried out under the guarantee conditions is free of charge. Our responsibility is limited to the repair of the instrument or, if we consider it necessary, to its free replacement.

The following are not covered by our guarantee : batteries and damage due to incorrect handling, failure to observe the instruction manual, or attempts by any unqualified party to repair the instrument ; any consequences whatever that may be connected either directly or indirectly with the instrument supplied or its use.

(Excerpt from our General Conditions of Delivery of 1 December 1981)

Brown & Sharpe TESA SA
CH-1020 Renens, 16.07.2001

J.-D. Richard
Quality Assurance Manager