CHAPTER 5
MACHINE SETUP

CONTENTS

References are made to relevant adjustment procedures that are described in the Operating Manual and this Service Manual.

5-1-1 Adjusting the CSM that uses a beam pointer

Before staring the adjustment procedure, a machine ORIGIN must be performed first.

5-1-1-1 Check beam pointer perpendicularity

Check visually the perpendicularity of the beam pointer with respect to the placement surface and attachment. This must be done to avoid the beam of the beampointer reflecting under an angle. When this is the case, inaccurate placements occur. For practical reasons, the front rail can serve as a reference for checking the perpendicularity of the beam pointer.

Check: every 2500 hours

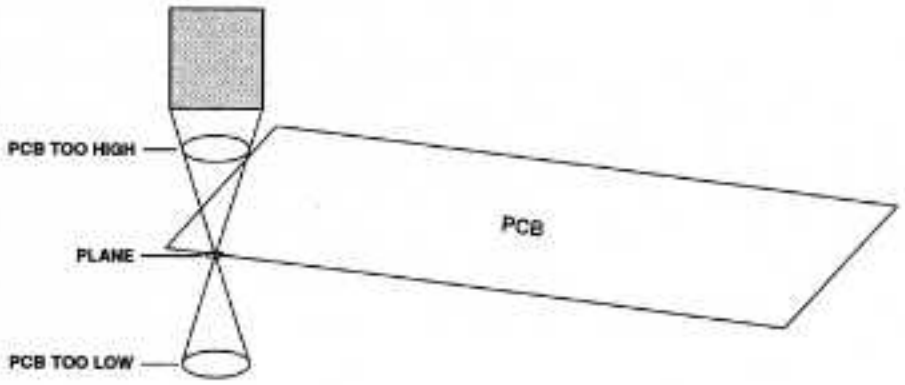
5-1-1-2 Focus beam pointer

Check if the PCB level is located in the focus of the beampointer. By moving the beam pointer up and down, the beam spot on the plate will become smaller and larger. When the spot is at its smallest point, the beam senso is in focus. This can visually be checked (the spot is then approx. 0.8 mm.).

Check: every 2500 hours

Reference: see chapter 6, section 6-3-5 (1).

Fig. 5-1 Focusing the beam pointer



5-1. Preface (Basic Machine Adjustment Procedure)

The basic machine adjustment procedure can be used in the following occasions:

- maintain process control
- recover from (head) crashes
- after replacing cameras or RDC heads
- after repair of cameras and RDC heads
- after adding extra heads or cameras

After recovery of head crashes, replacing heads or cameras, the software calibration procedure of section 5-4 must also be followed. If all data is lost, it is advised to first set safe softlimits (see section 5-4-3).

When placing components on a PCB, the CSM executes a number of steps in a logical sequence. In order to do this correctly, the CSM must meet some basic requirements. In the scope of process control, there is a need for an adjustment procedure for the CSM placement machines which checks and, if necessary, adjusts a number of required settings in a fixed sequential order. Since various parameters on the machine influence each other, this basic mahine adjustment procedure should be followed in a logical sequential order.

To point out the relationship between the various items of the machine, it is useful to review the sequence of product and data execution:

- The PCB is positioned by means of cylindrical positioning pins, making a relation between the PCB origin and the machine origin.
- Via this relationship, the beampointer or camera can determine the position of the PCB fiducial.
- The offsets between the chucks (center of the jaws) and the beampointer or camera is defined in the machine data. By means of this relationship, a relationship between the chuck and the PCB data is made.
- A component pick position is defined in the machine data (feeder file). In this way a component can be picked out of a calibrated feeder position.
- After picking a component from a feeder, the jaws will align the component. This alignment accuracy has a relation with a virtual shaft axis which is defined as the head offset with respect to the teaching tool.
- After aligning the component, the arms of the chuck will open and the component is retained to the nozzle by means of vacuum.
- Just before placement, the angle and the possible play of the nozzle, with respect to the jaws settings, determine the placement accuracy.
- Takeover of the component from the nozzle onto the PCB depends very much on the type of substance used to hold the component (glue, solder paste, etc.) as well as on the fixation of the PCB.
- The nature and intensity of the load on the PCB and component after placement and before the over process can influence the location differences of the component.

This chapter is a guideline for adjusting the CSM systems in a logical sequence which is necessary for obtaining a good process definition and process control.

5-1-1-8 Chuck adjustment

Check whether the arms of the chuck open and close smoothly. Make sure there is no play in vertical direction (when pulling the arm). If there is dirt between the inner and outer sleeve, then clean this with a cloth. The surface can be cleaned with, for instance, thinner. Do not grease the sleeves. Check all chucks used by the system. Check if the arms have not cut into the notches of the inner and outer sleeve. Check if the springs of the outer and inner sleeve are not weak. Check if the notches are located in the correct position.

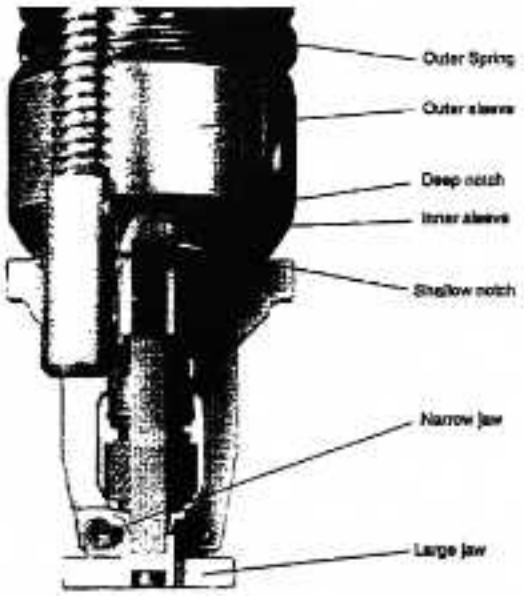
☎ WARNING !!

If the sleeve is not pressing on the arm at the correct position, the arm will vibrate, making it impossible to center components correctly. There is also danger of the arm bumping in to the feeder or other parts.

Check: every 800 hours

Refer to figure 5-2.

Fig. 5-2 Chuck & jaw adjustment



5-1-1-9 Jaw Adjustment

Check if the jaws are not worn out. Replace when damaged. For every jaw, it must be checked if the jaw centers the component in the center of the chuck. This can be done by means of the Chuck (Jaw) Adjustment Tool. Check all jaws used by the system. If, after adjusting with the adjustment tool, the head still places with an offset, then this must be adjusted in the machine parameters (system/position).

Check: Every 24 hours if the jaws are worn out.

Reference:

- Chapter 6, section 6-1-1, item (1).

Specifications on parallelity between X-Axis and fixed conveyor rail:

- CSM 66 ≤ 0.1 mm/330 mm
- CSM 84(V): ≤ 0.1 mm/460 mm

Reference: Chapter 7

5-1-1-6 Adjust feeder bar X pick-up point

To avoid wrong placements of the feeder, make sure that the feeder bar is clean. Place a feeder on position no. 7. Take with the beam pointer a reference point on this feeder. After this, place the same feeder on position 28. Move the beam pointer, by means of the hand held keyboard, only in the X+ direction and bring the beam pointer to the same location of the feeder on position 28. If it is found that the feeder bar is not parallel to the X-Axis, then the feeder bar position must be adjusted. This can be done by loosening the retaining bolts and by adjusting the feeder bar to the correct position. Secure the bolts once the bar is in its correct position.

Repeat this procedure for the rear feeder bar. Use feeder positions 57 and 78.

Check: Checking parallelity, according to specs, is not necessary unless there is a strong belief that there is an error in this section. This can be the case i.e. after head crashes.

Specifications on parallelity between X-Axis and Feeder bar reference holes:

- CSM 66: ≤ 0.2 mm/480 mm
- CSM 84(V): ≤ 0.2 mm/600 mm

5-1-1-7 Adjust feeder bar Y pick-up points

Check the Y-position pick-up point for each 'critical' type of feeder (such as 8 mm tape feeders). If the component cannot be picked correctly in the center of the pocket then adjust the Y direction of the feeder. For this adjustment the tape feeder adjustment tool can be used.

Check: every 1500 hours

Tape adjustment tool:

Reference:

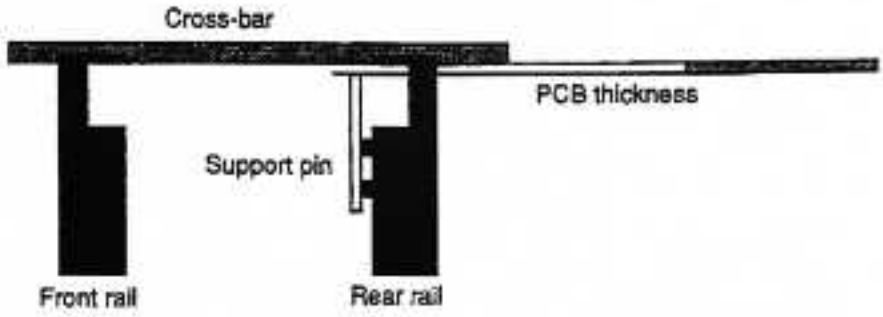
5-1-1-3 PCB support pins adjustment

Adjust the height of the support pins in such a way that the PCB is lying flat at the mounting position. Avoid that the PCB is pressed upward. This can be done by putting a flat cross-bar on the conveyor bar and adjust the pins at cross-bar position minus thickness of the used PCB's.

Check: every 1500 hours

Reference:

- Operating Manual CSM 66, 84, 84V III (5322 871 63104) chapter 9, section 9-3-1, 6) and 3).
- Service Manual CSM 66, 84, 84V III (5322 871 63603) chapter 1, section 1-1-6, (4).



5-1-1-4 Locale pin adjustment

The locating pins are default adjusted for PCB's with a thickness of 1.6 mm. Depending on the thickness of the board, the locating pins must be adjusted according to that thickness. Adjust the locating pins in such a way that, when in upward position, the pins are located at the center of the positioning hole of the PCB and so that the pins are not pressing the PCB upward when the PCB is in its mount position.

Check: every 1500 hours

Reference: Operating Manual CSM 66, 84, 84V III (5322 871 63104), chapter 9, section 9-3-1, item 2).

5-1-1-5 X-Axis and Locale pin parallelity

Check by means of the beam pointer whether the two locating pins, and in second instance, the front rail, are parallel to the X-Axis within 0,5 mm. Note that this is a visual check. The parallelity must be within reasonable proportions. The influence of a small error in this parallelity is very small since fiducial correction is applied on the PCB. In case of a severe problem in the parallelity of the conveyor system, it is needed to realign the conveyors by means of a gauge dial indicator, which should then be attached to the X-Axis.

Check: every 2500 hours

5-1-2 Adjusting the CSM that uses vision

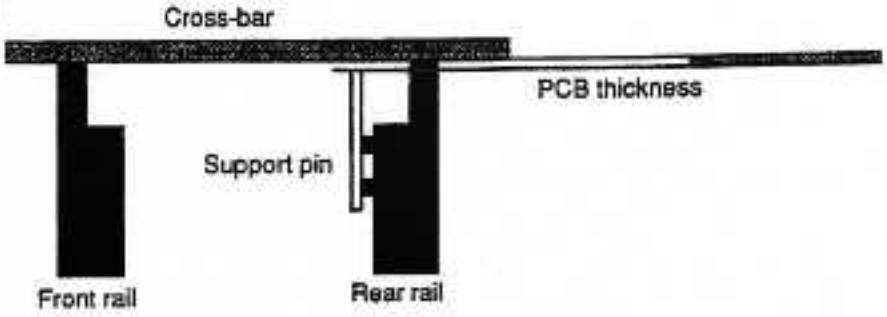
5-1-2-1 PCB support pins adjustment

Adjust the height of the support pins in such a way that the PCB is lying flat at the mounting position. Avoid that the PCB is pressed upward. This can be done by putting a flat cross-bar on the conveyor bar and adjust the pins at cross-bar position minus thickness of the used PCB's.

Check: every 1500 hours

Reference: see section 1-1-3

Fig. 5-4 PCB support pins adjustment



5-1-2-2 Locate pin adjustment

The locating pins are default adjusted for PCB's with a thickness of 1.6 mm. Depending on the thickness of the board, the locating pins must be adjusted according to that thickness. Adjust the locating pins in such a way that, when in upward position, the pins are located at the center of the positioning hole of the PCB and so that the pins are not pressing the PCB upward when the PCB is in its mount position.

Check: every 1500 hours

Reference: See section 1-1-4

5-1-2-3 Focus fiducial camera

Mount a PCB in the CSM and make sure it is correctly fixed by the push-up and locate pins. Place the fiducial camera above a clean (clear) fiducial. Loosen the camera fixation bolts a little and adjust the camera height so that, visually, an optimum sharp picture is obtained. Once obtained, tighten the camera fixation bolts again.

Check: every 1500 hours

Reference:

5-1-1-12 Adjust vacuum level

Adjust the appropriate vacuum lever per head for the range of components that will be used for that particular head. Checking the vacuum level is very important as, during production, the vacuum level of a head decreases due to the fact that nozzles get dirty or show signs of wear.

Using stickers on components can be a cause of high vacuum leakage or can even be a cause of wrong pick up. If vacuum leakage occurs, set the vacuum level to low. If the sticker causes mispicks, place stickers on a fixed position or change or try to avoid using stickers.

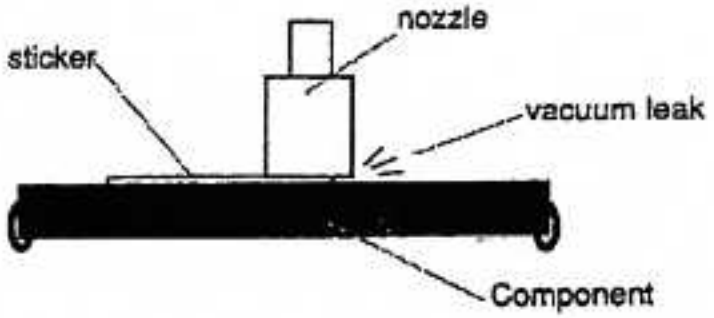
Check:

- check nozzle according to section 1.1.10
- check vacuum level every 2500 hours

Reference:

- Chapter 6, section 6-3-3, item (3), (5)
- Operator manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 4, section 4-4, item (2)

Fig. 5-3 Vacuum leak caused by stickers



5-1-1-13 Chuck calibration

Determine the placement accuracy of a component at a 0°, 90°, 180° and 270° mount angle. From these angles the jaw or head offset can be determined. Philips offers a very accurate etched aluminum calibration plate for this purpose. This calibration plate is delivered with CAD data and user manual. Before using this chuck calibration procedure, make sure that all machine offsets and machine coordinates are entered. Checking and programming offsets and coordinates is described in section 2.

Reference: Chapter 6, section 6-3-3

NOTE: The jaws can be checked without removing the complete chuck from the system.

5-1-1-10 Replacing nozzles

Check if the nozzle shows signs of wear. Wear on the nozzle (= vacuum leak) gives pick-up errors and random component rotation after alignment and before placement. Check all nozzles used by the system. Replace nozzle when damaged.

Check: every 24 hours and clean every 24 hours.

Reference (replacing nozzles):

- Chapter 6, section 6-1-1, item (1)B
- Operator manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 9, section 9-3-3

5-1-1-11 Adjust nozzle height

Adjust the height of the nozzle according to the range of components used. The relation between component type and used nozzle & jaw combination is specified in the table below:

Table 5-1 Chuck & Nozzle combinations

Chuck & Nozzle combinations	Mountable parts	
Type 1 - KLa	Resistor (box type)	(1.00x0.50)
Type 2 - ASb	Resistor, capacitor (box type) Resistor, capacitor (melf type) Tantalum Electrolytic Cap. Chip Inductor Minimold Transistor Power Transistor	(1.60x0.80 ~ 4.50x2.00) (Ø1.25x2.00 ~ Ø1.35x3.45) (2.90x1.50 ~ 4.70x2.60) (3.20x2.50) (2.90x1.50 ~ 4.00x3.00) (4.60x2.60)
Type 4 - ABe	Resistor, capacitor (melf type)	(Ø1.25x2.00 ~ 2.20x5.90)
Type 5 - Hg	Aluminum Electrolytic Cap.	(Ø4.30x4.30 ~ 6.60x6.60)
Type 8 - FGc	Capacitor (box type) Tantalum Electrolytic Cap. Film Capacitor Chip Inductor	(4.50x3.20 ~ 5.60x5.00) (6.00x3.20 ~ 7.30x4.30) (7.30x5.30) (4.50x3.20)
	Power Transistor SOP	(4.60x2.60) (6P ~ 24P)
Type 9 - FGd	SOP PLCC	(8P ~ 28P) Max size 18mm^2 (PLCC 44)
Type 10 - GJd	PLCC	Size 18mm^2 ~ 30mm^2 (PLCC44 ~ PLCC84)

Check: every 2500 hours

Reference:

- Chapter 6, section 6-3-3

On the CSM 84V the height of the vision head is programmable per component (component database) by means of the HEIGHT parameter. The lower limit should therefore be the position when the nozzle just touches the top of a fixed PCB. This value is programmed in the parameter HEAD.3 Z-OFFSET.

Check: When vision head is repaired/replaced.

Reference:

- Operator manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 6, section 6-4-3.

5-1-2-12 Check wear of nozzles

The nozzles in the ANE station should be checked for wear. Wear can lead to vacuum leak and can be a cause of component placement errors. When exchanging nozzles, the nozzles are retained to the shaft by means of support spring plates. Wear may occur on the location where the support spring plates hold the nozzle. This may lead to play of the nozzle on the nozzle shaft, resulting in incorrect component placement. In case of wear, replace nozzles.

Check:

- Clean nozzles, especially the SMALL nozzle, every day.
- Check nozzles for wear every 800 hours.

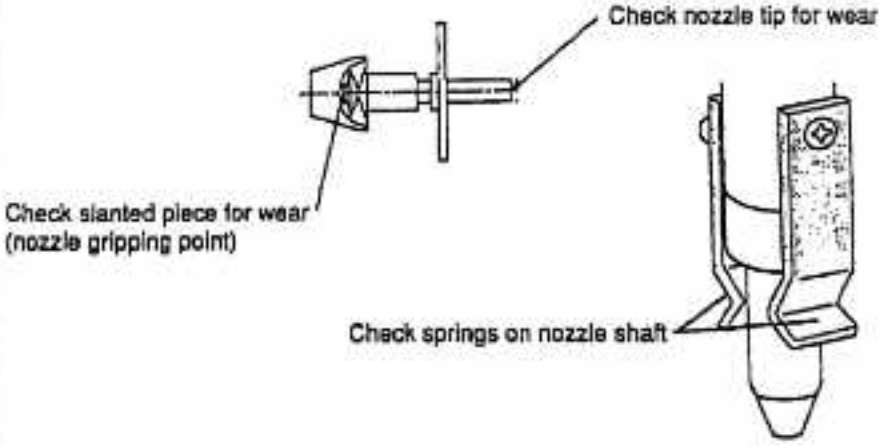


Fig. 5-5 Nozzle check points

5-1-2-13 Adjustment of chuck head nozzles & jaws

Adjust and check the chuck head(s) nozzles and jaws according to the sections 5.1.1.8 to 5.1.1.11 and 5.1.1.13.

5-1-2-7 X-Axis and Locate Pin parallelity

Same as section 5.1.1.5, only now the fiducial camera can be used as the checking unit.

Check: every 2500 hours

Specifications on parallelity between X-Axis and fixed conveyor rail:

- CSM66 ≤ 0.1mm/330mm
- CSM84(V) ≤ 0.1mm/460mm

5-1-2-8 Adjust beam pointer

If the vision system is also equippd with a beam pointer (usually), then adjust the beam pointer as is described in the sections 5.1.1.1 and 5.1.1.2.

5-1-2-9 Adjust feeder bar pick-up point

Same as section 5.1.1.6., only now the fiducial camera can be used as the check unit.

Check: every 2500 hours

Specifications on parallelity between X-Axis and Feeder bar reference holes:

- CSM66 ≤ 0.2mm/4800mm
- CSM84(V) ≤ 0.2mm/600mm

5-1-2-10 Adjust feeder pick up points

Use procedure as described in section 5.1.1.7.

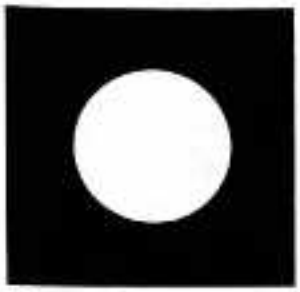
5-1-2-11 Adjust vision head descent limit

When, during placement, the nozzle lower limit is adjusted too low, it can cause damage to components or may lead to misplacement. If the nozzle lower limit is adjusted too high, the components drop from the nozzle and cannot be placed correctly. Therefore, the lower limit of the nozzle must be checked and, when necessary, adjusted. It is a standard procedure to adjust the lower limit in such a way that the nozzle just touches the PCB.

✍ NOTE:

Make sure that the vision head can handle all other used components. The head should handle at least the thinnest component.

5-1-2-4 Adjust fiducial camera brightness



For test: The area ratio between fiducial and background should be around 1:4.

The fiducial camera lens is a fixed lens and therefore the brightness cannot be controlled by adjusting an aperture ring on the lens. The tip of the lens is fitted into an LED assembly that distributes the light for the fiducial camera. The intensity of the LEDs on this board can be adjusted with the potentiometer which is on the LED PCB. It can be checked by taking a histogram of a good fiducial. Adjust the intensity of the LEDs until the fiducial mark can be read easily. If the background is saturated (near a threshold of 255), then the LED adjustment is incorrect. Background threshold (non-reflective) should be in the area of 10 _ 30 (fiducial:background = 1:4). When the intensity is set to a maximum and no improvement is obtained in correct fiducial recognition, then the LED PCB must be replaced.

Reference:

- Operator Manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 9, section 9-3-3, item 3), B

5-1-2-5 Camera origin

Check in the DATA IN-SYSTEM-POSITION-HEAD-OFFSET menu if the camera origin is set to X=0.00, Y=0.00.

Check: When memory losses occur

Reference:

- Operator manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 6, section 6-4

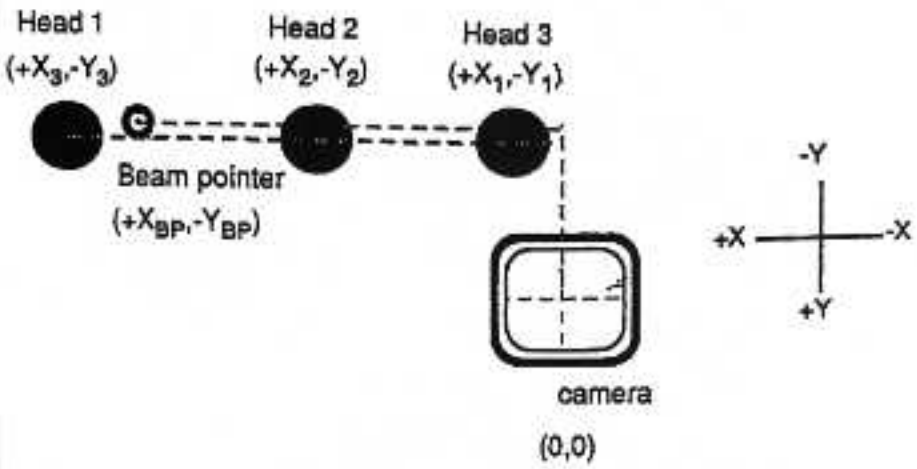
5-1-2-6 Calibrate fiducial

Determine the camera shift and scale values by calibration a good fiducial. When the X Scale value is divided by the Y scale value, then the correct scale value that should be obtained is:

	X/Y Ratio
VICS1000	1.00

✍ NOTE: To ensure correct system operation, it is recommended to always use the last version vision software.

Fig. 5-6 Offsets of heads and beampointer relative to teaching unit (in this example the fiducial camera)



✍ NOTE: Normally, the above is standard for the CSM. If for some reason your installation differs from the above, then the following actions are still valid. Make sure only that the correct X and Y directions are entered (positive or negative). The axis system as shown in figure 5.6 can be used to determine the direction towards the heads relative to the teaching unit.

5-2-1-1 Rough teaching of offsets

In the following sections all offsets are related to the camera. If the system you use does not have vision, then the way in which rough offsets are taught, as described, are still relevant, only everything must be seen with respect from the beampointer (like if the vision camera is replaced by the beam pointer).
Rough offset calibration must be performed first. After the rough offset calibration, fine offset calibration can be performed to define the exact head offset (by means of a CAD programme).

✍ NOTE: It is recommended to first define the machine soft limits and then to perform the necessary basic machine adjustments described in section 5.1 before starting any rough offset teaching.

1. Teach rough offset of the beam pointer

Step a. Place on top of the fixed rail a white sticker with a black dot with a diameter not larger than 0.8mm (print e.g. with a computer). A fixed reflective location of the same size on a PCB is also possible. The dot should not be too big or too small because it is then visually less accurate to determine the center of the dot when the beampointer is shining on it. This must be done as accurately as possible since the rough adjustment of the beam pointer is at the same time the fine adjustment.

5-2. Preface

✍ NOTE:

In good process control, it is highly recommended to always have a backup of all machine data on a personal computer. It is also highly recommended to save the data on a separate disk which is stored on a safe place.

Backup of machine date should always take place after every change that is made if the change concerns machine data.

The following sections describe briefly the procedure that should be followed in order to enter the correct machine parameters. Machine parameters normally change if one of the following occasions occurs:

1. Memory losses:
   This can happen if the backup battery has lost power. It only affects time and data!

   The battery backup approximately has a lifetime of ± 10 years.

2. System changes:
   When options or tools are added, replaced, repaired or moved in the system the appropriate position and, when necessary, offset must be taught again into the system. After these changes it is recommended to make a machine backup again.

The parameters that will be described in the following chapters are in the SYSTEM-POSITION-HEAD OFFSET menu and in the SYSTEM-POSITION-MACHINE POSITION menu. All other parameters, in other menus are selected by the user and/or are defined depending on the customer's needs.

5-2-1 System Offsets

The head offsets determine the distance between the various heads relative to the teaching unit. If the system is only equipped with a beam pointer, then this is the teaching unit. If the system is equipped with a teaching camera or the system is a vision system, then the vision camera is always the teaching unit. The teaching unit always has the coordinate X=0, Y=0. The offsets are entered according to figure 5.6.

The offset coordinates are normally defined as the distance that the heads have to travel in order to go to the teaching unit. The travel direction is done according to the machine coordinate system. The other way around is to take the teaching unit as a center and define the offsets from the teaching unit the heads according to the teaching unit (axis system is 180° turned since this unit is looking downward). The latter is shown in figure 5.6 (system with vision) and in the sideline (system with beampointer).

5-1-2-14 Adjustment of vacuum level

Adjust the appropriate vacuum level according to section 5.1.1.12.

5-1-2-15 Component camera adjustment

For correct placement of components that use vision, it is very important that the component camera is set up correctly. The setup is very dependent on the type of camera, the lighting system and the field of view that are used in the system.

Check: When camera is added (new camera), cleaned, touched, repaired/replaced or moved to another location. Also it must be checked when the whole system is moved to another location.

Reference: Chapter 6, section 6.3.5, item (2).

5-1-2-16 Component calibration

Without a correct calibration of the components, it is not possible to mount the components correctly. A very first calibration ever (only done once) also determines the head offset for the vision head. Since, during placement, references are made to the calibrated values in the vision file, it is very important that these values represent the component in its optimum condition. Therefore it is obliged to use **only** perfectly shaped and leaded components for calibration (also referred to as the 'golden component'). Calibration is successful if the calibration scale values in the vision file (of the calibrated component) represent a valid value. This can be determined by checking the ratio of the X and Y scale values.

	X/Y Ratio
VICS1000	1.00

✍ NOTE: To ensure correct system operation, it is recommended to always use the last version software.

Check: Calibrate at:
- every new component type used
- replacement or addition of component camera

Reference: Operator manual CSM 66, 84, 84V III (5322 871 63104)
Chapter 5, section 5-4.

Step g. Go to the menu SYSTEM-POSITION-HEAD OFFSET and enter the offset with the indicated sign bit of step h) into the head 1 parameter. See figure 5.8.

✍ NOTE: The rotation can only be determined after fine calibration.

Fig. 5-9 Rough head 1 offset teaching

SYSTEM			HEAD OFFSET	
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	**XY**	:	$+X_{H1}$	$-Y_{H1}$
	R	:	(see section 5.2.1.2 - **2.**)	
HEAD.2	XY	:	(see section 5.2.1.1 - **3.**)	
	R	:		
HEAD.3	XY	:	(see section 5.2.1.1 - **4.**)	
	R	:		
	Z	:		
TRACK WIDTH		:	(see section 5.2.1.1 - **5.**)	

✍ NOTE: For simultaneous pick the offsets of all three chuckheads must be located within 0.3 mm in X and Y direction with a max rotation of 10°.

3. Teach the rough offset of head 2

Teach the rough head 2 offset the same way as is described in section rough head 1 offset teaching and enter the coordinates in the menu as shown in figure 5.10.

Fig. 5-10 Rough head 2 offset teaching

SYSTEM			HEAD OFFSET	
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	XY	:	$+X_{H1}$	$-Y_{H1}$
	R	:	(see section 5.2.1.2 - **1.**)	
HEAD.2	**XY**	:	$+X_{H2}$	$-Y_{H2}$
	R	:	(see section 5.2.1.2 - **2.**)	
HEAD.3	XY	:	(see section 5.2.1.1 - **4.**)	
	R	:		
	Z	:		
TRACK WIDTH		:	(see section 5.2.1.1 - **5.**)	

2. **Teach the rough offset of head 1**

Step a. Bring, by means of the hand held keyboard, the head 1 to a known location. This can be the sticker with the dot as described earlier for teaching the beam pointer. Teach as correctly as possible so that the nozzle tip is placed at the center of the dot.

It is also possible to manually pick a nominal component out of a feeder and place this component on a self-defined position on a PCB.

Step b. Write down the X and Y coordinate as shown on the bottom of the UPOS screen, when the head 1 is taught as well as possible above the dot, or when the component was placed.

Step c. If the same sticker with the same dot is used as when teaching the beam pointer, then the coordinates, when placing the fiducial camera above this dot, are already known. In this case go to step e), otherwise repeat step a) to d) about teaching the rough offset of the beam pointer.

If a component was placed on a defined position, then the center of the component must be taught as correctly as possible. Add the X and Y corner positions and divide the results by 2 in order to find out the X and Y coordinates of the center of the component. Write down the calculated center coordinate.

✍ NOTE: If a component is used to determine the head offsets, make sure the chuck and jaws are properly adjusted first. This can be done with the chuck adjustment tool.

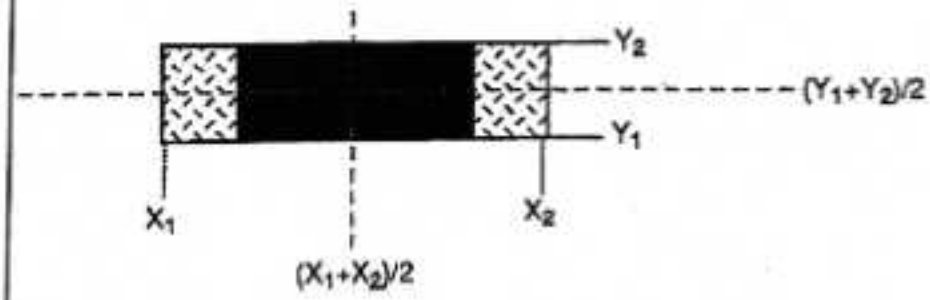


Fig. 5-8 Center position of a component

Step d. From both coordinates, subtract the two X values from each other (ignore the plus or minus sign).

Step e. From both coordinates, subtract the two Y values from each other (ignore the plus or minus sign).

Step f. When referring to figure 5.6., it can be seen that the head 1 offset related to the camera is at position (+Xbp, -Ybp).

Step b. Make a vision file that can recognize this dot. Use fiducial (FID) mode, set OBJECT to black and made the WINDOW1 as small as possible. The files do not need to be calibratd. Set OPTION05 to 1. Set all other options to 0.

Step c. By pressing SHIFT-G (=GO) try to teach the center of the dot. You will see two crosses on the screen. Try (for a perfectly round dot) to locate the two crosses on top of each other. (Two crosses: one is for the center of the processing window at pixel 239,255, the other is for the found center of the object).

Step d. If the two crosses are located on the same location, write down the X and Y coordinates that are displayed on the bottom of the UFOS screen (so: not the Vision screen).

Step e. Now go with the beam pointer to the same dot (in manual mode) and try to locate the red beam as well as possible on the center of the dot (dot and beam are nearly the same diameter size).

Step f. If the beam sensor is located on the most accurate possible position, write down the coordinates that are shown on the bottom of the UFOS monitor.

Step g. From both coordinates, subtract the two X values from each other (ignore the plus or minus sign).

Step h. From both coordinates, subtract the two Y values from each other (ignore the plus or minus sign).

Step i. When referring to figure 5.6., it can be seen that the beampointer offset related to the camera is at position (+Xbp, -Ybp).

Step j. Go to the menu SYSTEM-POSITION-HEAD OFFSET and enter the offset with the indicated sign bit of step i. into the beam sensor parameter. See figure 5.7.

Fig. 5-7
Offset beam pointer

SYSTEM			HEAD OFFSET	
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	**$+X_{BP}$**	**$-Y_{BP}$**
HEAD.1	XY	:	(see section 5.2.1.1 - **2.**)	
	R	:		
HEAD.2	XY	:	(see section 5.2.1.1 -**3.**)	
	R	:		
HEAD.3	XY	:	(see section 5.2.1.1 - **4.**)	
	R	:		
	Z	:		
TRACK WIDTH		:	(see section 5.2.1.1 - **5.**)	

The following steps should be performed:

Step a. Adjust the chuck speed, jaws, nozzle, nozzle height and vacuum level.

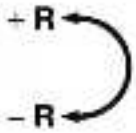
Step b. Use a reliable board with CAD data.

Step c. Mount 6 components with a chuck, on a close row, at 0° and 180°.

Step d. If there is any rotation (check, if available, with vision) then measure this rotation and enter the offset correction value in the menu as shown in figure 5.13.

Step e. Repeat step c) and d) until the rotation is as small as possible.

Fig. 5-13 Chuck rotation offset



If the mount deviation is in the +R direction (at 0° and 180°) then correct this by entering the -Rhxr offset.

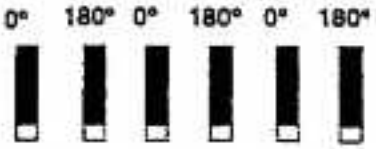
If the mount deviation is in the -R direction (at 0° and 180°) then correct this by entering the +Rhxr offset.

SYSTEM			HEAD OFFSET	
CAMERA		:	0.00	0.00
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	XY	:	$+X_{H1}$	$-Y_{H1}$
	R	:	R_{H1R}	
HEAD.2	XY	:	$+X_{H2}$	$-Y_{H2}$
	R	:	R_{H2R}	
HEAD.3	XY	:	$+X_{H2}$	$-Y_{H2}$
	R	:	R_{H3R}	
	Z	:	(see section 5.2.1.2 - 2.)	
TRACK WIDTH		:	$+Z_{TW}$	

Step f. Mount again 6 components at an angle of 0° and 180°. Offset and jaw correction are determined as shown in the following figures (separate directions are shown, but most of the time a combination of the figures below is found).

Correct Y offset (1)

Both angles all located too high. Correct Y offset of the head by the deviation amount. Here: all located too far in +Y direction. Subtract deviation from the Y offset.



5. Track width offset teaching

(Only applicable if the system is equipped with the automatic conveyor width option. This parameter is not meant for the Z-Axis of the CSM84V system as that is already defined in the HEAD3.Z parameter.)

The track width is the width of the conveyor after powering on the system. It is common to set this width to the size of the board being produced on the machine.

Step a. Set, by means of pressing the MW+ and MW- keys on the hand held keyboard, the width of the conveyor in such a way that the PCB can be smoothly moved by hand from the beginning until the end of the conveyor.

Enter the desired width (Ztw) into the TRACK WIDTH parameter. Refer to figure 5.12.

Fig. 5-12 Track width offset teaching

SYSTEM			HEAD OFFSET	
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	XY	:	$+X_{H1}$	$-Y_{H1}$
	R	:	(see section 5.2.1.2 - **1.**)	
HEAD.2	XY	:	$+X_{H2}$	$-Y_{H2}$
	R	:	(see section 5.2.1.2 - **1.**)	
HEAD.3	XY	:	$+X_{H2}$	$-Y_{H2}$
	R	:	(see section 5.2.1.2 - **2.**)	
	Z	:	(see section 5.2.1.2 - **2.**)	
TRACK WIDTH		:	$+Z_{TW}$	

5-2-1-2 Fine offset teaching

1. Fine offset teaching of chuck heads

Chuck heads can be on head 1, head 2 and/or head 3. In all cases, fine adjustment on these heads is done in the same way.

✍ NOTE:

Before using the chuck adjustment tools the HEAD OFFSET screen must have the correct values. Therefore, first check the system coordinates as described in section 2.2.

4 **Teach the rough offset of head 3**

If head 3 is a chuck head, then teach the rough head 3 offset the same way as is described in the rough head 1 offset teaching and enter the coordinates in the menu as shown in figure 5.11.

If head 3 is a VANE head, then **manually (never automatically since the nozzle station position and head 3 offset are not known yet)** insert the small nozzle on head 3 and carry out the following steps.

Step a. Set the system speed around 25% (for controlling the Z-Axis in the CSM84V system).

Step b. Bring head 3 to the sticker with the dot (as described before) and teach the position of the nozzle as accurately as possible on the dot. If the position is taught, write down the coordinates as shown on the bottom of the UFOS monitor.

Step c. If the same sticker with the same dot is used as when teaching the beam pointer, then the coordinates, when placing the fiducial camera above this dot, are already known. In this case go to step d), otherwise repeat step a) to d) about the rough offset teaching of the beam pointer.

Step d. From both coordinates, subtract the two X values from each other (ignore the plus or minus sign).

Step e. From both coordinates, subtract the two Y values from each other (ignore the plus or minus sign).

Step f. When referring to figure 5.6., it can be seen that the head 3 offset related to the camera is at position (+Xbp, -Ybp).

Step g. Go to the menu SYSTEM-POSITION-HEAD OFFSET and enter the offset with the indicated sign bit o step f) into the head 3 parameter. See figure 5.11.

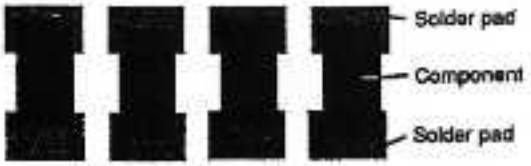
Fig. 5-11 Rough head 2 offset teaching

SYSTEM				HEAD OFFSET
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	XY	:	$+X_{H1}$	$-Y_{H1}$
	R	:	(see section 5.2.1.2 - **1.**)	
HEAD.2	XY	:	$+X_{H2}$	$-Y_{H2}$
	R	:	(see section 5.2.1.2 - 2.)	
HEAD.3	**XY**	:	$+X_{H2}$	$-Y_{H2}$
	R	:	(see section 5.2.1.2 - **3.**)	
	Z	:	(see section 5.2.1.2 - **3.**)	
TRACK WIDTH		:	(see section 5.2.1.1 - **5.**)	

Most of the times a combination between head offset and a zig-zag placement occurs. In this case it must be determined first if the placement occurs within specifications (±0.15mm for all chucks except GJ chuck which is ±0.30mm). Determine the center of the deviation of both angles and determine if this center is always located too far in X or Y direction. Enter this deviation in the X and Y head offsets.

Example

Step 1. Mount result gives:



Step 2. Check if deviation is within specifications:

Step 3. If deviation is **not** within specifications then adjust jaws until deviation is within specifications (repeat step 2).

Step 4. Determine the CAD center (via CAD data, camera teaching, etc.:

Step 5. After the CAD center is determined and the center of the placement of the components, then it can be seen if there is a difference between the two lines. In the example above it is found that the CAD center is lower than the found center. The head offset in this case is deviated too much in the +Y direction. Here, the Y-offset should be subtracted with the found deviation.

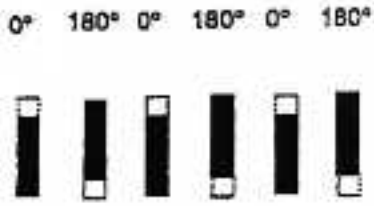
Using the same method, the X offset correction can be determined.

Fig. 5-15
Chuck X offset

SYSTEM			OFFSET	
CAMERA		:	**0.00**	**0.00**
BEAM SENSOR		:	$+X_{BP}$	$-Y_{BP}$
HEAD.1	**XY**	:	**$+X_{H1}$ (± offset)**	$-Y_{H1}$
	R	:	X_{H1R}	
HEAD.2	**XY**	:	**$+X_{H2}$ (± offset)**	$-Y_{H2}$
	R	:	$+X_{H2R}$	
HEAD.3	**XY**	:	**$+X_{H2}$ (± offset)**	$-Y_{H2}$
	R	:	$+X_{H3R}$	
	Z	:	(see section 5.2.1.2 - **2.**)	
TRACK WIDTH		:	$+Z_{TW}$	

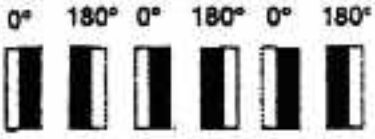
Jaw Correction

If the components are placed zigzagged in Y direction on the board, then the large jaws are not adjusted properly on the chuck assy. The chuck adjustment tool can be used to do a course adjustment. The result should be that placement should occur within specifications. All chucks, except the GJ chuck (±0.30mm), should place within a deviation of ±0.15mm.



Jaw Correction

If the components are placed zigzagged in X direction on the board, then the small jaws are not adjusted properly on the chuck assy. The chuck adjustment tool can be used to do a course adjustment. The result should be that placement should occur within specifications. All chucks, except the GJ chuck (±0.30mm), should place within a deviation of ±0.15mm.



Correct Y offset (2)

Both angles all located too high. Correct Y offset of the head by the deviation amount. Here: all located too far in -Y direction. Add deviation to the Y offset.

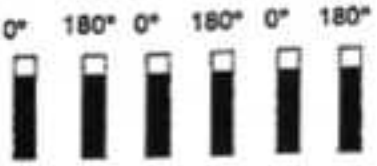
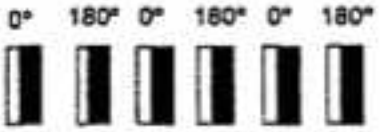


Fig. 5-14
Chuck Y offset

SYSTEM			OFFSET
CAMERA		0.00	0.00
BEAM SENSOR		$+X_{BP}$	$-Y_{BP}$
HEAD.1	XY	$+X_{H1}$	**$-Y_{H1}$ (± offset)**
	R	(see **1.**)	
HEAD.2	XY	$+X_{H2}$	**$-Y_{H2}$ (± offset)**
	R	$+X_{H2R}$	
HEAD.3	XY	$+X_{H2}$	**$-Y_{H2}$ (± offset)**
	R	$+X_{H3R}$	
	Z	(see section 5.2.1.2 - **3.**)	
TRACK WIDTH		$+Z_{TW}$	

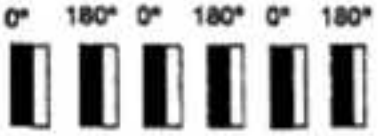
Correct X offset (1)

Both angles all located too far to the right. Correct X offset of the head by the deviation amount. Here: all located too far in +X direction. Subtract deviation from the X offset.



Correct X offset (1)

Both angles all located too far to the left. Correct X offset of the head by the deviation amount. Here: all located too far in -Y direction. Add deviation to the X offset.



5-2-2-5 Waiting point

The waiting point is a point where the heads of the CSM will always return to between mounting two boards. Also when no action is taking place on the CSM, this position is where the head section will move to.

As an example, a position can be chosen that is nearest to the first pick position of a running programme.

☞ WARNING !! Please note that when the EMERGENCY KEY is pressed, the heads will lower automatically. Therefore, it must be made sure that this position is not located above or near any obstacle that may cause damage to the head section.

5-2-2-6 Dumping point

If components can be dumped after a rejection, then the dump of the component will be on the location specified in this parameter. There is no fixed position for this point, however, the dumped component should not obstruct any object in the machine.

5-2-2-7 Front feeder date (only valid for tape feeders)

Instead of teaching every pick position for every tape feeder in the front of the system, you can also let the system determine this for you. The only input that must be given is a feeder set position according to the labels on the front feeder bar (define this in the FRONT.FDR.DATE parameter) and the exact pick position from a feeder on that feeder set position (define this in the DATE XY parameter).

Once this parameter is entered, the AUTO-SET option can be used in the feeder file, and the CSM will automatically calculate the pick position of this feeder.

✍ NOTE: It is recommended to use a feeder that was adjusted with the feeder adjustment tool. Take as a reference feeder an 8mm feeder with a relatively small component.

For feederbar parallelity, refer to section 5.1.1.6.

5-2-2-8 Rear feeder date (only valid for tape feeders)

The same as front feeder date (see 5.2.2.7) but now pick a position on the rear feeder bar.

5-2-2 System coordinates

☞ WARNING !! If all machine data is lost, that means that there are no coordinates available in the machine concerning the machine softlimits. Therefore, when teaching these limits, the system speed should be set as low as possible to avoid the head section crashing into the hard stop limits.

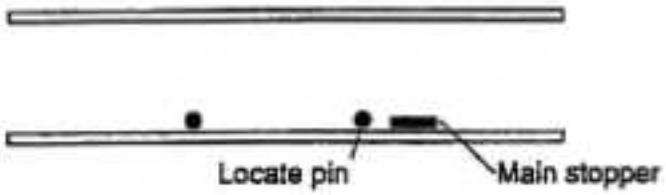
✍ NOTE: Before teaching system coordinates, a return to origin must have taken place.

5-2-2-1 +softlimits Please refer to chapter 6, section 6.4.2 of the operator manual (CSM 66, 84, 84V III (5322 871 63104).

5-2-2-2 -softlimits Refer to 5.2.2.1.

BASIC MACHINE SOFTWARE CALIBRATION

5-2-2-3 Locate pin Teach the position of the locate pin (nearest to the main stopper) as precisely as possible with the teaching tool.



5-2-2-4 PCB corner After a PCB is stopped by the main stopper and fixed by means of the locating pins, teach the corner of the PCB located nearest to the main stopper.

2. Fine offset teaching of vision heads

✍ NOTE: First: teach camera position as is described in section 5.2.2.12.

The only time that a vision head can be calibrated is during the calibration process of the very first component ever calibrated on the machine. With the very first component the utility MOUNT FEEDBACK should be executed. At the question: 'CHANGE HEAD OFFSET' the answer should be 'YES'.

By entering 'YES' you will give the final offset location of HEAD 3 relative to the teaching camera. Generally this never should be changed again (except at head crashes, camera addition or replacement, moving the system, etc.). Therefore, when any other MOUNT FEEDBACK will be executed, the anser to the question 'CHANGE HEAD OFFSET' should always be answered with 'NO'.

☞ WARNING !! Bear in mind that with the answer 'YES' the offset of HEAD 3 has changed. When using an Automatic Nozzle exchange station, the nozzle positions should be taught again. Incorrect location of the nozzle station coordinates may cause damage to the vision head.

If the component camera position was taught accurately, the change in head offset, after calibration, will be minor. As most items accessed with head three are not so critical, it is not necessary to teach these positions again. However, as stated above, the only critical item in the machine that needs to be taught accurately is the nozzle station. In case a critical item or component is placed in the system and is accessed by head 3, then it is recommended to teach the position of this item or component again after the head 3 offset is changed.

Reference:

- Operator manual CSM 66, 84, 84V III (5322 871 63104)
- Chapter 8, section 8.2.2
- Chapter 5, section 5.4.7

3. Head 3. Z Offset teaching (only valid on the CSM 84V)

This value determines the lowest point the Z-Axis can reach during a running process. This defined value is when the tip of the nozzle just touches the PCB. In pick and place process this value can be overruled by the Z-POSITION and HEIGHT parameter.

✍ NOTE: None of these parameters may exceed the -Z softlimit

5-2-2-11 Temporary stations

1. **Temporary station 1 XY**

The temporary station 1 is the front pad of the shuttle.

- Bring the shuttle into the CSM area
- Insert the small nozzle onto the (V)ANE head
- Bring the (V)ANE head above the front pad of the shuttle
- For the CSM84V: put the speed of the system to _25 % (or slower)
- Lower the head 3 nozzle and locate the (V)ANE head on that position where the small nozzle falls into the center of the front pad.
- Go to the SYSTEM-POSITION-MACHINE-POSITION menu
- Teach this position into the TEMP.STA1 parameter

2. **Temporary station 2 XY**

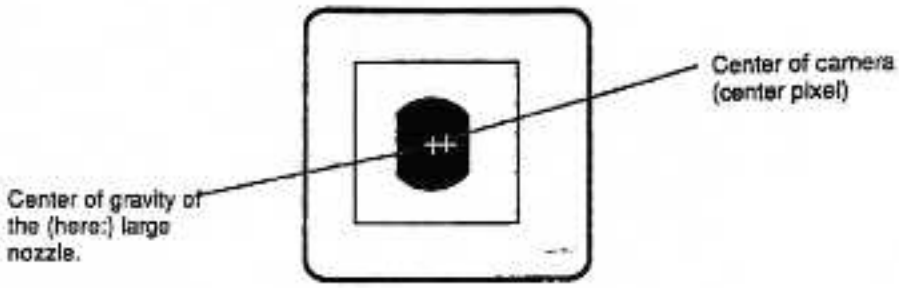
The temporary station 2 is the rear pad of the shuttle. To teach this point, follow these steps:

- Bring the shuttle into the CSM area
- Insert the small nozzle onto the (V)ANE head
- Bring the (V)ANE head above the front pad of the shuttle
- For the CSM84V: put the speed of the system to _25 % (or slower)
- Lower the head 3 nozzle and locate the (V)ANE head on that position- where the small nozzle falls into the center of the rear pad.
- Go to the SYSTEM-POSITION-MACHINE-POSITION menu
- Teach this position into the TEMP.STA2 parameter

e. Set the system speed low. Move the head section to that point where the two crosses overlap each other.
f. The coordinates that are shown on the bottom of the UFOS monitor (so, not the vision monitor) should now be put into the CAMERA 2XY parameter.

It is **not** necessary to calibrate the vision file. The center of the camera is a fixed position as it is the center pixel of the screen (coordinate depends on vision system used). When using FID mode the vision system determines the center of gravity of the object. From a perfect object (as the large nozzle is) this can be done quite accurately. When the two crosses can be located on top of each other then the center pixel of the screen is a much as possible at the center position of the nozzle. It can then be said that head 3 is located exactly in the center of the camera's field of view.

Fig. 5-16 Teach center of component camera



2. **Camera 3 XY**

For correct component placement it is necessary to teach the center of the camera as accurately as possible. Camera 3 is the 'second' component camera that is used in the system. Teaching the center of the camera is done in the same way as described above.

3. **Camera 4 XY**

For correct component placement it is necessary to teach the center of the camera as accurately as possible. Camera 4 is the 'third' component camera that is used in the system. Teaching the center of the camera is done in the same way as described above.

5-2-2-9 Nozzle station

If an automatic nozzle exchange system is used the positions for the small, medium and large nozzle must be taught.

☞ WARNING !! If the (V)ANE head offset is changed, the positions of the three nozzles in the automatic nozzle exchange station must be taught again. Wrong positions of the nozzle station may cause damage to the vision head when exchanging nozzles.

1. **Nozzle 1 XY position**

Teach the position of nozzle 1 (medium) as exactly as possible. Try more than one time and make sure that, by repeatedly lowering the (V)ANE head, the transition of the nozzle 1 into the nozzle station is done as smoothly as possible.

2. **Nozze 2 XY position**

Teach the position of nozzle 2 (large) as exactly as possible. Try more than one time and make sure that, by repeatedly lowering the (V)ANE head, the transition of the nozzle 2 into the nozzle station is done as smoothly as possible.

3. **Nozze 3 XY position**

Teach the position of nozzle 3 (small) as exactly as possible. Try more than one time and make sure that, by repeatedly lowering the (V)ANE head, the transition of the nozzle 3 into the nozzle station is done as smoothly as possible.

5-2-2-10 Cameras

1. **Camera 2 XY**

For correct component placement it is necessary to teach the center of the camera as accurately as possible. Camera 2 is the 'first' component camera that is used in the system. Teaching the center of the camera can be done as follows:

a. Insert the largest nozzle onto the VANE head
b. Create a vision file that selects camera 2
   - select for MODE the FID mode
   - make object BLACK
   - all options, except option 5, should be set to 0
   - set option 5 to 1
   - create a WINDOW1 not too large
c. Move, by means of the hand-held keyboard, the nozzle above the camera 2. Press GO to find out if the nozzle can be interpreted by the vision camera as a fiducial.
d. The vision screen shows two crosses. One is the center of the camera and one is the center of the object.