

Chapter 1

Introduction

The FlexiSpense is a liquid dispenser for microplates and other rectangular test containers.

1.2 Specifications and features

1.21 Features

- ∨ **Choice of single tip or manifold**
Whether your application requires fast bulk dispensing or adding reagent selectively, FlexiSpense offers the optimum solution.
- ∨ **Preprogrammed plate layouts**
Standard formats from 24 well plate to 384 well plates are already defined, any other container format organized in rows and columns can be programmed.
- ∨ **Wide volume range**
From adding stop solution to filling pre dilution tubes.
- ∨ **Low dead volume and back-pump capability**
Save expensive reagents.
- ∨ **Long life piston pump**
High precision over life time.
- ∨ **Flexible dispensing pattern**
Start and stop position and dispensing order can be programmed.
- **Easy operation and programming**
User dialogue in multiple languages.

1.22 Specifications:

| | |
|---|--|
| Volume range: | 25 µl to 10 ml (Single tip version) 10 µl to 5 ml (Manifold), minimum volume down to 5µl available on request |
| Volume increments: | 25 µl as standard (single tip version), 10 µl (8-channel manifold), other volume increments on request |
| Accuracy: | +/- 1.5% (whole volume range) |
| Precision: | +/- 1% (whole volume range) |
| Dispensing speed: | 90 sec.(96well plate, 200µl per well, single tip) 13 sec. (8-channel manifold) |
| Dispensing modes: | row, column, serpentine |
| Number of plates: | up to six |
| Plate formats: | 24, 48, 96 and 384 well preprogrammed (single tip), up to 9 patterns programmable, Tube racks programmable 96 - and 384 well preprogrammed (Manifold) |
| Start and end position: | programmable |
| Maximum plate height | 68 mm (single tip), 45 mm (Manifold) |
| Display: | alphanumeric LCD with backlight, 2 x 20 character |
| Number of programs: | 15 |
| Computer interface: | RS232 |
| Power: | 85 to 264 V, 47 - 440 Hz, max. 70 Watt |
| Environmental conditions (operational): | Humidity 5 to 90 %, non condensing, maximum altitude 2000 m, temperature 5 to 40°C. |
| Dimensions: | 440 (W) x 550 (D) x 220 (H) mm |
| | |

Chapter 2

Installation

2.1 Introduction

This chapter contains the necessary information for installing the instrument.

The installation procedures involve unpacking, power requirements and environmental requirements.

2.2 Unpacking and Inspection

The instrument is shipped in one carton that includes:

- Instrument,
- Pump unit
- Accessories
- Power cord
- Instruction manual (This manual)

2.2.1 Unpacking Procedure

1. Visually inspect, the container for damage, before opening it.
Report any damage immediately to the forwarding agent or to the delivery carrier.
2. Place the carton in an upright position and open it.
3. Remove the upper cardboard box carefully.
4. Lift the instrument out of the carton and place it on a flat surface, free from dust, vibration and away from direct sunlight.
5. Visually inspect the instrument for loose, bent or broken parts.
Report any damage immediately.
6. Compare the instrument's serial number, attached on the rear panel of the instrument, against the serial number of the instrument, on the delivery (shipping) note.
6. Check the instrument accessories against the delivery (shipping) note.
7. Please save all packing materials, as they maybe required for later transportation.

2.3 Power requirements

The instrument has an universal power supply which requires no setting for the local voltage. The voltage must be in the range from 85 to 264 V AC, 48 to 400 Hz.

WARNING:

For safe operation of the equipment it is mandatory that it is connected to a wall socket equipped with a ground (earth) connector.

Ensure, that the voltage supplied to the instrument is correct to this specification and the correct rating and type of fuses are fitted.

Fuse Ratings: 800 mA T

For instructions how to change fuses please refer to chapter 4 of this manual.

2.4 Environmental requirements

The instrument should be placed on an even surface that is free from dust, solvents and acidic vapors.

Vibration and direct sunlight should be avoided.

Before the instrument is installed and switched on, it should be left to stand for at least 2 hours, so there is no possibility of condensation causing a damage or malfunction..

2.5 Instrument installation procedure

The following procedures detail the necessary steps to be followed when installing the Instrument.

1. Place the instrument into the required position
Ensure, that the distance between the back panel of the instrument and the wall, is at least 5 cm.

Remove all packing material and transport lock tapes.

2. Remove all packing material from the pump module. Place the pump module on the top cover with the pump head showing to the right so that the connector at the bottom of the pump head mates with the 9-pin connector in the top cover. Secure the pump module with a knurled screw on both sides of the pump module.
3. Slide the short silicon inlet tube on the fitting at the lower port of the pump head.
4. Place the tube holder into the hole of the holder block on the pump housing and secure it with the knurled screw.
5. Single tip only :
Screw the long discharge (dispensing) tube with the Delrin nut into the upper port of the pump head. Put the other end of the tube with the metal pipe through the hole of the tube holder. Now put the dispensing tip into the carriage.

Adjust the height of the dispensing tip that it is approximately 3 mm above the respective microplate.

6. Manifold:

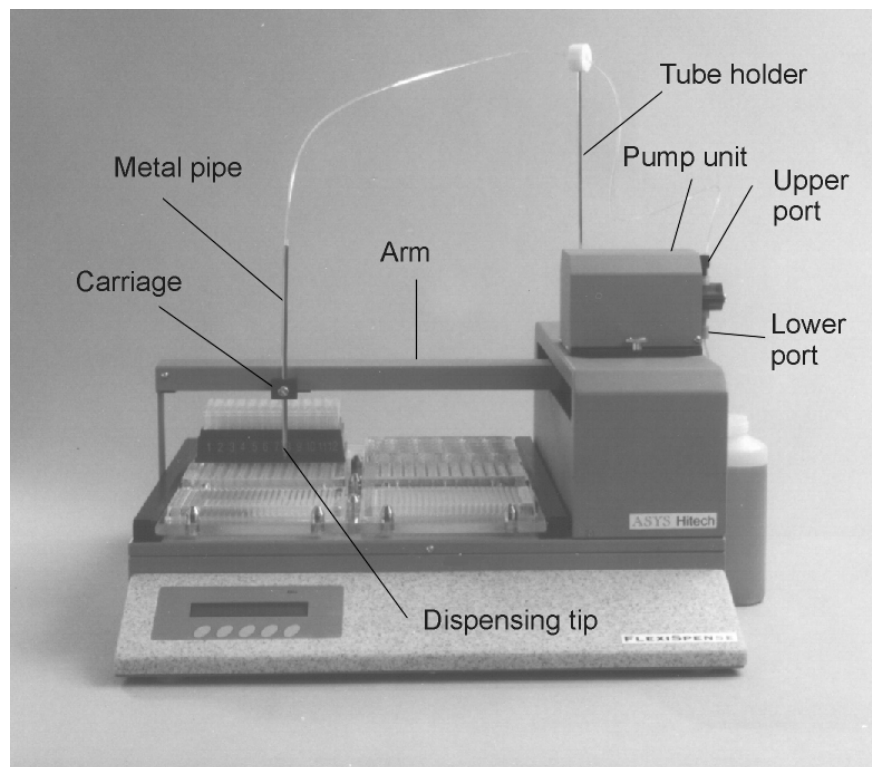
Assemble the manifold with the angled bracket to the holder at the rear of the dispense arm and secure it with the knurled screw. The height should be adjusted so that the tips are approximately 2 mm above the plate surface.

Screw one of the fittings into the upper port of the pump head and the other one into the manifold.

7. Ensure that the mains power switch at the back panel of the dispenser is in the OFF position.

8. Insert the power cable into the mains power socket in the back panel of the instrument.

9. Switch the dispenser on.



Chapter 3

Operation

3.1 Basic operation rules

3.1.1 Display description

The first (upper) display line shows current options or actions, the second line gives the description of the current possible key commands.

3.1.2 Special key functions:

- ↑ Scrolls the menu upwards, increments a numeric value by one
- ↓ Scrolls the menu downwards, decrements a numeric value by one
- Moves the cursor to the right, in case a well position is indicated the column number will be incremented.
- ← Moves the cursor to the left
- ↵ Enter key, confirms a selection
- ESC** Escape key, leaves the current selection.
- CL** Erases a numeric input, respectively sets the default value.

3.2 Operation

After the instrument is switched on, the arm moves to the home position and the display shows the main menu. Now you can select the required operation.

| | | |
|-----------|---------|---------------------------------------|
| operation | PRIME | - preparation of the system for |
| | SETUP | - definition of instrument parameters |
| | PROGRAM | - programming of a dispensing action |
| | RUN | - performs a dispensing program |
| | BACK | - pumps the liquid back |

3.21 Prime

After the selection 'Prime' is confirmed, the arm moves to the prime position. Make sure that the prime reservoir is in the correct position. Press the key 'YES' to start the prime procedure. If the prime volume is not sufficient, repeat the prime procedure. You can stop the prime procedure any time by pressing the STOP key. For best priming results it is recommended to interrupt the prime procedure a few times for some seconds so that air bubbles can escape from the pump head.

3.22 Setup

The menu setup has the following menu options:

- ◆ Plate def.
- ◆ Plate del.
- ◆ min. Volume
- ◆ Pump
- ◆ Pmp. Speed
- ◆ Workspace
- ◆ Manifold
- ◆ Language
- ◆ Exit

3.22.1 Plate def. (Plate definition)

This menu option allows to define and edit plate formats.

24, 48, 96 and 384-well plates are already defined (96 and 384-well plates for instruments with 8-channel manifold) . To define new plate formats proceed like follows:

Select the menu 'Plate definition'. Press the arrow up key until an undefined plate ID. is shown.

Plate ID.: 5 (undef)

↓ ↑ ESC ↵

Press the **ENTER** to confirm that a new plate will be defined.

Now you can enter an alphanumeric name for the new plate, for example the numbers of well. The name can be up to six digits.

NAME:

→ ↑ CL ESC ↵

Press the arrow up key until the desired first digit is displayed. Press → to move to the second digit. Select the desired number. If you want a third digit press the key → again and enter the last number. If the entered number is wrong, press **CL** to erase the input. When the number is correct, press **ENTER**.

The next step is the definition of the well positions. First the number of rows and columns must be made known to the instrument.

The following message is shown on the display:

| | |
|------------|---------|
| Last Pos.: | H / 6 |
| ↓ → | ESC ↵ |

Now the designation of the last well position should be entered. This is defined as the well located in the bottom right corner, e.g. H-12 for a 96 well plate. Based on this input the software can determine the number of rows and columns for the new plate format.

Press the ↓ key until the desired row character is displayed, then press the → key to select the desired column number. When the last well has been entered correctly, press **ENTER**.

The next step is to define the positions of the plates on the plate holder. This will be performed by means of a teach-in procedure. The dispensing arm moves to the default first dispensing position and the exact location can be controlled with the arrow keys. The display shows the following:

| | |
|-------------|----------|
| sel. Plate: | 1. Plate |
| ↑ ↓ | ESC ↵ |

Press the Enter key to define the location of the first plate.

| | |
|------------|--------------|
| 1. Plate : | 520 / 1255 |
| E ← X → H | E ← Y → H OK |

By means of the keys 'E' and 'H' you can move the dispensing arm in both X (front/back) and Y (left/right) direction. 'E' is the abbreviation for End position, which is the utmost front respective left position. 'H' is the abbreviation for the Home position, which is the utmost back respective right position. The numbers show are the step counts for both the X and Y drive motors.

The tip of the single-channel dispenser respective the **rear** tip of the manifold should be moved close to the well A-1. Confirm the position by pressing the key OK . The next step is to fine-tune the position.

| | |
|------------------|--------|
| Fineadjustment ? | YES |
| ESC | NO YES |

Confirm the message with the key 'YES' so that the fine adjustment is possible. The next menu enables you to move the arm in single-steps for a precise positioning.

| | |
|-----------|--------------|
| 1. Plate | 524 /1258 |
| E ← X → H | E ← Y → H OK |

Especially in case of 384-well plates the accurate position of the dispense tip is important. Move the tip with the arrow keys exactly to the center of the well

A-1. Verify that the tips of the manifold are in line with the center of column 1. Confirm the position with the key 'YES'.

Now the procedure must be repeated for the other 5 plate locations. Afterwards the position of the last (bottom right) well should be defined. This is only required for the plate in position 1.

| | |
|-------------|--------------|
| POS. H/12 : | 388 / 1258 |
| E ← X → H | E ← Y → H OK |

The definition for the Endposition is similar to the definition of well A-1.

Please note that in case of the 8-channel manifold the front tip of the manifold (this is the one which is close to the front of the instrument) must be aligned with the bottom right well (H-12 respectively P-24).

After the position of the End position has been defined successfully the arm moves back to the home position. The plate definition is finished now and you can return to the main menu by hitting the **ESC key**.

3.22.2 Plate del(ete)

The menu option allows to erase plate definitions which are no longer required.

3.22.3 min(imum) Vol(ume)

The minimum volume menu option allows to enter the minimum pump volume. This volume is defined as the volume per channel that is dispensed during one revolution of the pump motor.

The setting for the minimum volume will depend on the configuration of the instrument. It can be set in 5µl steps from 5µl onwards. If the minimum volume is changed, the display prompts if the existing dispense programs should be erased. Because a modification of the minimum volume may cause a wrong dispensing volume for existing dispense programs, the existing programs should be erased. Only in cases the modification of the volume is for trial purposes the dispense programs may stay untouched.

WARNING: The change of the setting for the minimum volume does not change the actual dispense volume per revolution. To change the actual volume a mechanical adjustment of the pump is required. This adjustment should only be performed by trained service personnel. The setting of the minimum pump volume in this menu option is to inform the software about the actual pump volume.

3.22.4 Pump

The pump sub-menu enables the modification of the pump speed indices Pump speed 1, 2 and 3. These speed indices can be chosen within the dispensing programs. The displayed speed is in RPM (revolutions per minute)

In case of the pump setting of 10µl/revolution the following speed values are programmed as default:

Speed 1: 2800
Speed 2: 3000
Speed 3: 3200

Note: These values are for standard instruments and may be different if the instruments has been optimized for a special kind of liquid.

Depending on the liquid characteristics like viscosity and surface tension a lower or higher speed index may improve the dispensing accuracy. Especially in case that some droplets may be seen at the tips of the manifold a different speed will reduce the problem.

3.22.5 Pmp. Speed

This option allows to define the pump speed index for prime and back pumping. Typically the speed 3 gives the best result.

3.22.6 Workspace

Here you can set if microplates or tube racks will be used. The use of racks is only possible with the single-tip version. The rack option allows to use the whole area for one tube rack.

3.22.7 Manifold

In this option the type of the installed manifold should be selected. Before a new defined manifold type can be used, the default position must be defined in the service program by a competent person.

3.22.7 Language

The dialogue language can be selected using this menu option.

3.22.8 Exit

Confirming this message terminates the setup menu.

3.23 Program

This menu should be chosen when you want to establish or edit a dispensing program.

Depending if your instrument is equipped with a single-tip or a manifold the programming procedure will be different.

3.23.1 Single-tip version only

The display will show:

| |
|----------------------|
| Program: 1-96 |
| ↓ ↑ CL ESC ↵ |

You can select the desired program number (1 to 15) by scrolling with the up -- down arrow keys. When the desired number is displayed, press **ENTER**. The display will present:

| |
|-----------------|
| Plate ID: 1-96 |
| ↓ ↑ ESC ↵ |

This step allows the selection of the desired plate format. You can select from the predefined formats (see 1.22.2) by means of the arrow keys. After the desired plate is displayed, press **ENTER**. Now the display will present:

| | |
|----------------|----|
| Disp. vertical | NO |
| ESC YES | NO |

Here you can select the dispensing direction horizontal (rows) or vertical (columns). Press **YES** if you want the dispensing direction to be vertical and **NO** if you want the horizontal dispensing direction. When the selection has been made, the display shows:

| | |
|-------------|----|
| Serpentines | NO |
| ESC YES | NO |

You can select if the dispensing should be performed in serpentines or not. The selection of serpentines results in faster dispensing.

After the desired selection has been performed, the display presents:

```
Startpos,;  A/1
↓    →    CL ESC ↵
```

This command is used to determine the start position for the dispensing. The key ↓ can be used to select the desired row, the key → to select the desired column. Confirm the selection with ENTER. The display shows:

```
Endposition: H/12
↓    →    CL ESC ↵
```

Here you can choose the desired end position for the dispensing. Confirm the selection with **ENTER**.

The next message is shown:

```
Volume:      200
←    ↑    CL ESC ↵
```

This command is used to indicate the volume of liquid that should be dispensed. The available volume increment is depending on the pump setting, the standard setting is 25 µl for the single tip. When the liquid volume has been defined, press **ENTER**.

The last option for the dispensing program is to choose the pump speed (Dispensing speed). Three steps are possible, 1 is the lowest and 3 the highest speed.

```
Pmp. Speed: :    2
←    ↑    CL ESC ↵
```

The programming procedure is finished now, If you want to define another dispensing program, choose a new program number and proceed as above. To terminate the program mode press the **ESC** key.

3.23.2 Manifold version

To define a new dispense program choose a program number which is not be defined:

| | | | |
|---|----------|-------------|---|
| ↓ | Program: | 4- (undef.) | |
| ↑ | CL | ESC | ↵ |

You can select the desired program number (1 to 15) by scrolling with the up -- down arrow keys. When the desired number is displayed, press **ENTER**. The display will present:

| | | | |
|---|-----------|------|---|
| ↓ | Plate ID: | 1-96 | |
| ↑ | | ESC | ↵ |

This step allows the selection of the desired plate format. You can select from the predefined formats (see 1.22.2) by means of the arrow keys. After the desired plate is displayed, press **ENTER**. The next screen prompts you to enter the program name .

| | | | |
|---|-------|-----|---|
| → | Name: | 96 | |
| ↑ | CL | ESC | ↵ |

The default name is the plate name, any six-digit alphanumeric name can be you can defined. After the program name has been defined the start position can be chosen.

| | | | |
|---|------------|-----|---|
| ↓ | Startpos.: | A | |
| → | CL | ESC | ↵ |

Select the column where the dispensing should be started. After the start column has been chosen and confirmed by pressing the **ENTER** key the display shows:

| | | | |
|---|--------------|-----|---|
| ↓ | Endposition: | H | |
| → | CL | ESC | ↵ |

Now select the final column to be dispensed. Confirm the selection by hitting the **ENTER** key. The next step is define if columns should be omitted or not.

```
Use Col. 1 ?   1 1 1 1 1 1
←   ↑   →   ESC   ↵
```

With the left / right key you can select a column. The current column is indicated by an underline. To disable dispensing for the selected column press the ↑ key. The character 1 is changed to a 0 (zero), indicating that this column is omitted during the dispense run. After all columns that should be omitted have been selected, press the Enter key.

The next message prompts to select the dispense volume.

```
Volume:      10
↓   →   CL   ESC   ↵
```

The volume can be selected in multiple increments of the minimum pump volume.

The next step is to choose the pump speed index. Three steps are possible, 1 is the lowest and 3 the highest speed.

After the pump speed has been chosen and confirmed the last program step shows up.

```
Prime:  10
↓   ↑   CL   ESC
↵
```

Here you can define the so-called pre-prime volume. This volume is dispensed into the waste trough prior to the dispense run. In case of low dispense volumes and longer interval times between dispense cycles the use of the pre-prime can improve the accuracy. When no pre-prime is desired the volume can be set to 0 (zero).

The programming procedure is finished now. When you want to define another dispensing program, choose a new program number and proceed as above. To terminate the program mode press the ESC key.

3.24 RUN

To run a program, select Run from the main menu and press **ENTER**.

The display will show:

| | |
|----------|----------|
| Program: | 1-ABS96 |
| ↓ ↑ | CL ESC ↵ |

Use the up/down arrow key to choose the desired program and confirm your selection with **ENTER**.

The display shows then:

| | |
|-----------------|----------|
| No. of Plates : | 1 |
| ↓ ↑ | CL ESC ↵ |

Choose the number of plates that should be filled with the up/ down arrow keys and confirm your selection with **ENTER**.

At the end of the list of dispensing programs you will see 'temp.def.', here you can enter a so-called temporary program. The programming of a temporary program follows the same rules as for a regularly program. Please note that a temporary program will be erased when the dispenser is switched off.

| |
|---|
| NOTE: Make sure that the plates to be filled are already in place before you press the ENTER key. The dispensing process will start immediately after the ENTER key is pressed. |
|---|

During dispensing process the actual plate and well position is indicated. You can stop the dispensing by pressing the **STOP** key. After the dispensing is finished the arm moves back to the home position.

3.25 Back

The prime function serves to delivers the liquid in the system back into the reservoir.

After the selection 'Back' is confirmed, the arm moves to the prime position. Make sure that the prime reservoir is in the correct position. Press the key 'YES' to start the back pump procedure. If the system is not completely emptied, repeat the Back procedure.

Chapter 4

Maintenance

4.1 Introduction

This chapter gives the instructions on how to maintain, clean and disinfect the 'Flexispense' instrument.

4.2 Cleaning the Instrument

This instrument is a precision instrument and requires regular cleaning to ensure the continued precision.

Liquid Spills

If any liquid is spilled on the instrument, it should be IMMEDIATELY removed so that the liquid does not attack the surface of the housing.

Regular cleaning

The housing of the instrument should be cleaned regularly with a mild household cleaning agent.

Warning: Do not use aggressive solutions

The plate platform should be cleaned with a dry cloth .

4.21 Cleaning the pump

Routine flushing with solvent before shut down will suffice for most applications.

Caution: Ceramic piston/cylinder sets are sensitive to neglect and may 'freeze' if allowed to dry out without adequate cleansing. Fill a loop of flexible tubing with fluid that will thin or neutralize the last fluid pumped. Then connect one end of the tube to the pump suction port, the other end to the discharge port. With this loop positioned above the pump head, the ceramic surfaces and seal areas stay moist and mobile for extended idle periods. If, however a piston does freeze in the cylinder, DO NOT TRY TO FORCE IT FREE. Contact your dealer on how to solve this problem.

4.22 Cleaning the manifold

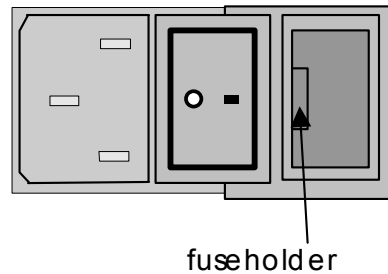
To avoid a blocking of the tips the system should be rinsed with distilled water after any use.

If one of the tips is already blocked, remove the manifold from the arm. Use the cleaning wire to poke carefully into the tips and remove dried residues with it.

Afterwards assemble the manifold back to the arm and rinse the system with distilled water.

4.3 Changing the Fuses

4.3.1 The following steps must be performed to replace the fuses, which are located at the power cable receptacle, in the rear panel of the instrument.



WARNING !

Before replacing fuses, disconnect the power cord. To avoid risk of fire, replace fuses only with same type and rating.

1. Switch off the instrument and unplug the power cord.
2. Open the plastic cover of the fuse compartment, by inserting a screw driver into the slot of the cover and pushing the cover out.
3. Pull the fuse holder away from the instrument.
4. Replace the defective fuses.
Ensure that the fuses have the correct rating.

85 to 264 Volts

0.8 Amp T

5. Replace the fuse holder.
6. Reconnect the power cord and switch the instrument on.

WARNING: If the fuses continues to blow, please call for service.

4.3.2 Power supply fuse:

The power supply fuse is inside the instrument located on the power supply board. This fuse is not user replaceable, replacement should be performed by a qualified service technician only. The rating of the fuse is 2A F.

4.4 Disinfecting Procedure

If the laboratory has no specific disinfecting procedure, the following procedure should be used to disinfect the instrument.

The instrument should be disinfected using a suitable disaffection solution.

1. Disconnect the instrument from the mains power supply.
2. Carefully wipe all the outside surfaces of the instrument and the plate area with a wad of cotton wool that has been soaked in the disaffection solution.

Ensure that disposable gloves are worn.

- 3 Place the instrument in to a large plastic bag.
4. Place a wad of cotton wool that has been soaked in the disinfecting solution in to the plastic bag.

Ensure that the wad is not touching the instrument.

5. Close and seal the plastic bag.
6. Leave the instrument to stand in the plastic bag for at least 24 hours.
7. After the standing time, remove the instrument from the plastic bag and wipe all the outside surfaces of the instrument and the plate support area with a wad of cotton wool which has been soaked in a 50% Alcohol solution.
8. Repeat the disinfecting procedure on any accessories which are also being moved or returned.

The pump can be disinfected by dispensing a sufficient amount of disinfectant fluid. After the disinfecting procedure dispense > 200 ml of distilled water to remove all disinfectant fluid from the liquid carrying parts.

4.5 Error messages

Pump Error: This message indicates that the pump drive is overloaded temporarily.

Possible causes are a too high pump speed, dried residue on the pump piston or a very high viscosity of the dispense liquid.

Remedy: Reduce the pump speed or try the cleaning procedure described in 4.21

Transport Error: Indicates that either one of the X or Y transport does not reach the position sensor after a movement in time.