Operating Manual

CTC A200S
Liquid Sampler

CTC A200S AUTOSAMPLER

Operating Manual

Printing History

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I. Introduction

Automation of laborious, tedious, repetitive tasks in an analytical laboratory has received a great deal of attention in the last decade. One area that still has to catch up is the automation of sample preparation. Even though the analysis of a sample is a standardized procedure, sample preparation has been left with many uncertainties and variations. Analytical methods normally start as hand-methods. Automatic analysers have been developed, but sample preparation and the loading of samples are still plagued with many uncontrolled variables, which hamper higher reproducibility and productivity.

CTC Analytics is making a substantial contribution in the sample preparation and injection areas. The GC autosampler A200S for many commercial testing, pharmaceutical research and chemical industry laboratories has become the autosampler of choice. The A200S provides a great deal of flexibility. The autosampler fits onto practically all GC brands and models that have vertical injection ports. That hardware adaptability is combined with user selectable parameters, which provide full optimization of the injection method for each application. The basic parameters are sample volume, number of needle washes with two different solvents, syringe plunger speeds, and pre- and post injection delays.

This manual is designed to:

- familiarize the end user with all the features of this versatile instrument
- indicate caution and warning where hazards and problems for the end user exist
- provide a clear terminology for the instrument, for easy communication with the support organization
- serve as a handbook for accessing the complete range of the instrument's programmability, and for performing service and maintenance functions.

Note: If a special software option has been purchased, check supplement to this manual!

The A200S Autosampler is built very ruggedly, and therefore has a very good service record. As long as the regular maintenance (see Chapter 5, Maintenance and Service) is performed, and the user of the instrument follows the instructions in this manual and those given by the qualified installer, a surprisingly high uptime level can be expected for many years. The safety of anybody coming in contact with this instrument has been a major concern of the designer and manufacturer.

2. Description

The Autosampler A200S has a modular design. The injection head, the crossrail unit, the instruments base unit with the vial tray drive and the instrument's main body with the electronics are the three main modules. Each module is described in this chapter. Numbers in round brackets refer to positions in the pictures in Figures 1, 2, 3, and 4 in the back of the manual.

Injection Head

2.1 Injection Head (Figure 1 & 2)

The injection head's function is to transport liquids either from vial to vial or from vial to the GC injection port. The injection head carries the syringe and provides the two essential motions of the syringe. It lowers the whole syringe to let the syringe needle pierce through the vial septum until the needle tip is well submerged into the vial's liquid. And it also provides for the syringe plunger motion that causes aspiration or dispensing of the liquids.

The **syringe (1)** is held in the **syringe carrier (2)**.

The syringe needle's tip is held by the black **needle guide (4)**, the rotational **syringe fixing lever (3)** and by the spring loaded **plunger holder (5)**. The needle guide is pushed all the way down by spring loaded **needle guide rods (6)** when not pushed up by resistance, such as a vial cap or the injection nut of a GC.

There are two mounting holes in the back wall of the injection head through which the injection head is mounted to the **cross-slide (18)**. The two holes with the hex wrench screws become visible when the syringe carrier is moved up or down until the hole in the syringe carrier back wall lines up with one of the two mounting holes in the injection head tube.

The **needle guide (4)** also has the function of a sample vial detector. If there is no vial in a position of the batch to be processed, the instrument will automatically skip to the next vial.

The injection head has a **top cover (11)** that is fastened with two Philips head screws. Motor and electronic switch connections can be checked when removing that cover or by reaching in through the open bottom side of the head.

The head contains the syringe Z-motor and the plunger motor. It also contains three proximity switches and their electronics, one each for the syringe carrier and the plunger home positions and one for the vial detection.

There is only one electrical connection between the injection head and the processor board . The **flat cable (15)** is supported by a flat **metal flex band (16)**.

Crossrail

2.2 Crossrail (Figures 1, 3 & 4)

The crossrail provides the movement along a sample tray row, the solvent and waste vials and injection positions. The **cross-slide (18)** is driven by the **cross-motor (28)** via a **toothed belt (19)**. On one end the crossrail has a simple black metal **end cover (22)**, on the other end the **cover (21)** also provides for the mounting of the **control terminal (8)**. The **cross-rail dust cover (9)** is attached to the two ends of the crossrail and the sides of the **cross-slide (18)**. These accordion dust covers have to be detached from the end covers for some of the X-motion adjustments. The control terminal can be switched from one side to the other to accommodate left side or right side injection. The crossrail contains the X-motion **home position (10)** and **injection point switch (20).**

This module is attached to the instrument main body by four **screws (29)** through the side panels. There are four electrical connections between the crossrail and the instrument main body. Flat cables between the processor board to the control terminal, one each to the two switches and one round wire cable to the cross-motor.

Instrument Base Unit

2.3 Instrument Base Unit (Figures 3, 4 & 5)

The bottom plate **(31)** of the instrument also provides the mounting flange normally used to mount the instrument to an adaptor plate that interfaces with the GC top. The base has the vial tray motion (Y-drive) mounted to it. The **tray drive motor (50)** hidden behind the **back panel (32)** of the instrument main body moves the tray in and out via a belt and worm gears on the right and left sides. The motion is transmitted to the **cooling plate (27)**, which is partially hollow to allow cooling fluid circulation to cool the tray and vials. The cooling inlet and outlet tubing is fastened to **connection fittings (34 & 35)** on the instrument **back panel (32).** The **tray home position switch (42)** is located inside the base unit. A small grey flat cable connection for the tray switch and a four wire cable connection to the tray motor are on the base module.

The instrument main body provides the vertical carrying structure for the crossrail and the injection head. It also houses all power distribution and most of the electronics. The inside of the body is accessible through a **top cover (33)** and a **back panel (32)**. These covers are fastened with Philips head screws. Removing the top cover gives access to the front side of the **processor board (48)** and the **transformer (43)**.

The back panel holds the **AC power connection box (36)**, the **GC interface connector (37)**, the **RS232 connector (38)** and the optional **parallel port (BCD) connector (39)**.

All wire connections to the processor board are keyed. This does not allow erroneous switching of connections unless excessive force is used.

Control Terminal

2.4. Control Terminal (Figure 6)

The operator communicates with the control program of the A200S Autosampler via a control terminal.

Parameter values and messages are displayed on a two line liquid crystal display (LCD). On the first line, and sometimes at the beginning of the second line there is a description of the menu or the parameter. Values are displayed on the second line below the corresponding description. A selected parameter value (i.e. a value that can be changed) is displayed as blinking.

All input is done by using eight push button keys. The keys are arranged in two groups. On the left side there are four keys to access different functions (UTL, MET, INJ and CLR key). On every function key there is a light emitting diode (LED). They are used to mark an operating state when constantly lit or that a key may be pressed when blinking.

Four keys labelled with arrows are used to input values. The parameter to be changed is selected by pressing the left arrow key (LEFT key) or the right arrow key (RIGHT key) until it is displayed as blinking. The value is increased with the up arrow key (UP key) and decreased with the down arrow key (DOWN key). If a low or high limit is reached, the value wraps around to the other end of the valid range. If a value having a valid range of 1 to 200 is 10 and should be set to 180, it is faster and more convenient to use the DOWN key so that the value wraps around to 200.

Consumables

2.5 Consumables

The syringe used is an easily obtainable glass syringe made by Hamilton Co., Reno, Nevada, US or Hamilton Co., Bonaduz, Switzerland, Product No. (701 N, US; 701 SN-51-25S-1-N, Switzerland). Other manufactures make equivalent syringes.

Sample vials are of specific size for each of the 3 vial trays offered.

10 x 20 tray: O.D. has to be 7.3 mm maximum, height has to be between 34 mm and 42 mm. Chromacol #07-CPV(A), or equivalent; septa & caps #8-AC-ST15

7 x 15 tray: O.D. has to be 11.6 mm maximum, height has to be between 30 mm and 38 mm. Chromacol #2-CV, or equivalent; septa & caps #11-AC-ST15

4x8 tray: O.D. has to be 20.6 mm maximum, height has to be between 32.5 mm and 40.5 mm. The same vials as for solvent and waste can be used.

3. Installation

Unpacking

3.1 Unpacking

When unpacking, please check very carefully that all items listed on the packing list are included in the shipment.

Position the main body of the instrument on a flat table and go through the following check list.

Check that the instrument is set at 220V, 240V, 110V or 120V. The arrow within the small window on the AC power connection box (see 36, Fig. 4) has to point to one of those settings. **Measure the voltage level on the outlet that you are using to power your instrument!** If voltage is below 240V or 120V, the instrument should be set for 220V or 110V. There is a little drawer in the AC power connection box that holds the fuses and the voltage switch element. With the use of a small flat head screw driver, the drawer can be pried outwards. The green square element can be pulled out and turned to select the correct voltage. **If you change voltage insert the appropriate fuse as indicated on the back panel.**

Unpack the injection head. Push the cross-slide (see 18, Fig. 3) all the way to the opposite side of the control terminal. Take off the two mounting screws that are stored on the cross-slide front side. Keep one of the screws on the Hex wrench and line up the hole on the syringe carrier with the upper hole of the back casing of the injection head. The two holes in turn need to be aligned with the upper hole on the cross-slide front and the screw has to be pushed through and tightened to mount the injection head. Now slide the syringe carrier downward until the hole lines up with the lower hole in the injection head back casing. The second mounting screw can be inserted and tightened.

Unpack the sample vial tray and insert it into the cooling plate (see 27, Fig. 3). A vial with a crimp cap should be placed into the last position in row #1. Make sure the power switch is in the off position. First plug the power cord into the instrument power socket, then into the AC wall outlet. Turn on the power switch. The instrument should initialize all motors and the display should show the main menu (see 4.4 and Fig. 7).

Selecting Injection Side

3.2. Selecting Injection Side

Depending on the GC model, the autosampler is mounted on either the left or right hand side of the GC injection port. In some cases it's possible to set it up either way. But in other cases such as when the two injection ports are positioned front and back, the autosampler needs to be setup with the crossrail running front to back and the vial tray from left to right, so that both ports can be accessed. See special installation instruction for this case.

The autosampler can be setup with the injection point on the right or left hand side. To switch from one to the other side, some hardware and software changes are necessary.

The control terminal and the solvent/waste bottle holder need to be moved from one side of the instrument to the other. In case the two solvent option is used (solvent and waste vial on both sides of the instrument casing) only the control terminal has to be changed. Then the home position switch (which has been the inject position switch before) has to be adjusted for proper alignment to vial position.

Solvent/Waste Bottle Holder

3.2.1 Solvent/Waste Bottle Holder

Loosen the two Philips head screws holding the bottle holder to the instrument. The solvent/waste bottle bracket (see 30, Fig. 4) on the bottle holder needs to be taken off by loosening the two Philips head screws. Move the bracket to the other end of the bottle holder and fasten it so that the bottle holder can be attached to the side wall of the instrument housing. All necessary holes are pre-drilled and tapped.

Position of Control Terminal

3.2.2 Position of Control Terminal

Two screws (see 13, Fig. 4) hold the control terminal to the black end cover of the crossrail. Loosen them and unplug the flat cable (see 14, Fig 3 & 4) connecting the control terminal to the instrument's processor board. It's best to take the injection head off too (follow instructions under 3.1 in reverse order). Open the top cover (33) of the instrument main body by taking the 5 screws off. Disconnect the tray drive motor, the position switches and the splitter valve connector. The 2 x 2 crossrail mounting screws (29) that are on both side panels of the instrument need to be taken off. Carefully lift the crossrail up and lay it on top of the instrument so that the cross-motor points down and the crossrail dust cover is up.

The flat cable for the control terminal (14) has to be taken out of its channel and diverted to the other end of the crossrail. There is a small aluminum plate holding the cable in the channel at the point where it makes a 90 degree angle towards the control terminal. That plate needs to be carefully slid towards the outside, to give free access to the cable bend. The best way to free the flat cable from the channel is to use a flat screw driver blade to reach underneath the cable and pry from one side until the cable can be grabbed. Now, use the other hand to help get the cable out of the channel as far as to the middle of the crossrail. The exposed cable can now be swung over to the other side of the crossrail and inserted, in a similar fashion, back into the channel. Be sure to insert the aluminum plate that will hold the cable at the bend. Remount the crossrail carefully. Fasten the 2 x 2 crossrail mounting screws on each side panel of the instrument. Take off the black end covers at each end of the crossrail and swap their position. Also, move the control terminal end cover (2) to the other side of the control terminal. Plug the flat cable into the control terminal.

Software Setup and Switch Adjustment

3.2.3 Software Setup and Switch Adjustment

Selection of injection side, number of injection points and adjustment of home position switch will follow in paragraphs 3.4 , 3.5 and 3.6.

Mounting on Gas Chromatograph

3.3 Mounting on Gas Chromatograph

The CTC A200S comes standard with the instrument bottom plate extending into mounting flanges. In some cases the autosampler can be mounted directly onto the GC cover plate. In many cases it is advisable to use an adaptor plate that is specifically furnished by CTC Analytics or by its authorized representative.

Marking the Mounting Holes

3.3.1 Marking the Mounting Holes

In cases where the autosampler can be mounted directly onto the GC cover plate position the completely assembled autosampler on top of the GC, beside the GC injection port. Optimize the position of the autosampler in such a way that at least two, ideally all, flange mounting holes are resting on the GC cover. Make sure the autosampler is square to the GC body. The crossrail, with the injection head mounted, has to be aligned with the injection ports of the GC. Mark the flange holes on the GC cover with a soft pencil. Take the autosampler off the GC top. Unscrew the GC cover. When taking the cover off make sure you follow all instructions in the GC manual. Before the mounting holes can be drilled into the GC cover, it is very important that you carefully inspect that the mounting bolts that will be used will not touch or push against any inside parts in the GC. It might be necessary to re-assess the exact positioning of the autosampler in order to avoid any physical interference between the mounting bolts and GC parts. Also at this point, it is important to assess the path of any interface wiring between the autosampler and the GC.

Drill Holes and Mount the GC Cover

3.3.2 Drill Holes and Mount the GC Cover

Once the holes are drilled, the autosampler should be mounted onto the GC cover before positioning the cover on top of the GC. For mounting, it's ideal to use a sturdy bolt of appropriate length and a serrated washer that is placed between the bolt head and the underside of the GC cover. Insert a flat washer before the nut is put onto the bolts.

Positioning the Autosampler

3.3.3 Positioning the Autosampler

Once the cover plate with the autosampler is mounted on top of the GC, the fine adjustments can be made. With the autosampler still off, position the injection head with the syringe mounted over the injection port. Manually push the syringe down until the syringe needle is as close to the injection port nut as possible without touching it. Should the position in the Y-direction (perpendicular to the crossrail) be off, you need to slightly loo-

sen the instruments mounting bolts and move the instrument the needed amount in the Y-direction (make sure you move the instrument parallel to its square position). After properly positioning the instrument the mounting bolts need to be tightened. A proper positioning allows the syringe needle to smoothly penetrate the injection port at exactly the centre of the injection port hole.

Setting System Parameters

3.4 Setting System Parameters

The selection of the setup parameters has to be done through the System Setup Program (see Fig. 8). Take the syringe off. Hold down the MET key on the control terminal while you turn on the instrument. You have entered the System Parameter and Adjustments level of the sampler program. The display shows SET PARAMETERS blinking (see Fig. 8). Push INJ to enter that option. INJECTION SIDE is displayed on the first line of the display. The second line shows either RIGHT or LEFT. In order to switch, the up or down arrow key will toggle to the other option. From the INJECTION SIDE menu position use the right arrow key to get to CLEAN POSITION. Select the value matching your configuration of solvent/waste vials. Pressing right arrow again leads to NO OF INJ POINTS. If you are planning to inject within your methods into 2 GC ports choose 2. If you only want to inject into one port choose 1. In case you chose 2 ports, push again the right arrow key to specify the position of the second port. For the inner port, a so called X-DIFF has to be entered (0.1 mm). X-DIFF is the distance from the outer port to the inner port.

The next three parameters let you choose the desired start condition for the autosampler. For several combinations of sampler and GC information about cabling and start parameter setup is available from your dealer. Push right key again. The tray selection mode should normally be on DISABLED unless you are using different trays on the same unit. Push right arrow again. In this window make sure the correct vial tray (10x20, 7x15 or 4x8) is shown.

Now you can leave System Setup Program by pushing CLR. The SET PARAMETERS line blinks.

Adjustments in X-Direction

3.5 Adjustments in X-Direction

If you have changed injection side the home position switch must be adjusted. Even though the CTC Autosampler A200S coming from CTC Analytics or an authorized dealer has been properly adjusted for the autosampler's internal positions, it's a good idea to double check this alignment.

The sample vials in the first row, the wash liquid (solvent) and the waste vial positions are all in a fixed X-distance from each other. Therefore, one ad-

justment of the injection head position adjusts all these positions. The adjustment is made on the X-home position switch. This switch is on the opposite side of the injection port side. The proper positioning is checked against the outermost vial position on the injection side in the first row of the sample vial tray.

Remove the top screw holding the control terminal (13, Fig. 4) and loosen the bottom screw. Remove the dust cover screws (49, Fig. 4) to get access to the X-home position switch. Push the right arrow key once. ADJ SAMPLE POS blinks. Push INJ to select this function and follow section 4.6.2. Then leave this function with CLR, push right key three times until ADJ INJECTION is displayed blinking. Again select with INJ, then adjust the injection point in X-direction by moving the inject position switch as described in section 4.6.5.

Adjusting Injection Depth

3.6 Adjusting Injection Depths

Your GC manual will indicate (either in the operating instructions or in some technical drawings) the optimum injection depth, i.e. the position of the needle tip in relationship to the top of the injection port. Follow 4.6.5 for adjustment.

You can also adjust depth for solvent (see 4.6.3) and sample pickup (see 4.6.4).

Preparing the Syringe

3.7. Preparing the Syringe

Install the syringe in the syringe carrier (see Fig. 2) and lock it by turning the white syringe fixing lever (3) 90 degrees. Take care when inserting the syringe that the needle is threaded into the hole of the needle guide (4). Push the spring loaded plunger clamp up (small hollow screw) so that the plunger head freely slips into the plunger holder (5). Move the plunger holder down until the plunger is at bottom to adjust dead volume to zero. **The plunger must be pushed down every time the autosampler is started or the syringe is changed.**

After the syringe is installed and the dead volume has been adjusted, it is advantageous to execute a cleaning cycle by using the utility function CLEAN SYRINGE (see 4.5.2). The syringe is moved to the wash solvent vial where 10 microliters of solvent are pulled up. Then it is moved back to the waste position and the plunger is moved down to eject the solvent. This procedure is repeated as many times as is specified in the clean with solvent count of the actual method. It may be interrupted by pressing the CLR key. The syringe is also cleaned when a sample has been injected or the injection cycle is aborted and the syringe is already contaminated.

To fill up the cleaning solvent vial the operator may move the injection unit to a place where it doesn't interfere with taking the vial out of the holder. Before the next injection cycle the position of the injection head is automatically reset to the waste position.

Warning:

Warning:
Not replacing the solvent/waste vial's septa, or not using a septum, may cause sample cross contamination. The septum is part of an effective syringe needle cleaning concept.

4. Operation

Overview

4.1. Overview

The operator communicates with the instrument software through the control terminal (see Fig. 1). In case a remote control operation is indicated, please read Chapter 6.

Note:
For any special software versions, check supplement to this manual.

The control terminal (8) is an 8 key keypad with a two line LCD display. The keypad has two groups of keys, 4 function keys and 4 arrow keys. The structure of the software can be depicted as a horizontal arrangement of all the programmable parameters. Therefore, the left and right arrow keys (see Fig. 6) give access to the individual parameters. Once the parameter is chosen the value itself can be changed with the use of the up and down arrow keys. For the horizontal arrows, the display will wrap around when the last or first parameter, for the vertical arrows when the maximum or minimum value is reached. Figures 7 and 8 show this concept graphically.

The three function keys MET, UTL and INJ access particular segments of the software. MET gives access to parameters that define a complete injection method. It is possible to store up to 9 individual sets of parameters in method storage slots. UTL gives access to useful functions, e.g. cleaning a syringe. The INJ key triggers the start of a run, or is used as an ENTER key in some cases. It also enters a lower menu level in the System Setup Program.

The CLR key stops a run. On the different programming levels, the CLR key is also used to terminate a particular function and return to the next higher menu.

The operator has four access levels to the software after the instrument is installed on a GC (see 4.2 and Fig. 7 & 8):

- System Setup Program — Affects parameters valid for all methods, defines machine setup values and gives access to test procedures and adjustments
- Method Parameters — Affects parameters that can be different from method to method.
- Method Execution — Start and stop of a run; select first and last sample position and repetitions.
- Utility Functions — For daily routine functions: single sample injections, syringe cleaning and tray type selection.

In order to reduce the risk of accidentally changing system parameters and adjustments, the system parameter portion of the software has a special access. Turn the instrument off, then hold the MET key down as the instrument is switched back on, to access the system parameter level. Once all parameters are set, the system parameter level can be left by pressing the CLR key.

When the main power is turned on, the A200S enters the STANDBY state. In this state the sampling range, the number of times every sample will be injected and the method to execute the sampling cycle are selected at the control terminal. These four values define the injection range to be processed. The parameters describing a sampling cycle are stored in an injection method. By changing the method number, a different parameter set is recalled. The operator can change individual parameters of the selected injection method with the MET key (see section 4.3).

The samples to be analysed are prepared, and the vials put into the sample tray. Then the sampling range (FST, LST) is defined corresponding to inserted samples. After a clean syringe is inserted into the injection head, the dead volume has been adjusted and a few washing cycles have been executed, the A200S is ready for operation.

Pressing the INJ key changes the operating state from STANDBY to READY. The next sample number, the injection count for this sample and the injection method number used are indicated on the control terminal. In the READY state the instrument is ready to inject the next sample as soon as it receives the GC ready signal.

When processing the selected sample number range, the control program detects and skips missing vials, so that no empty cycles are performed. After injecting the sample, the syringe is cleaned and the injection head moved to the home position.

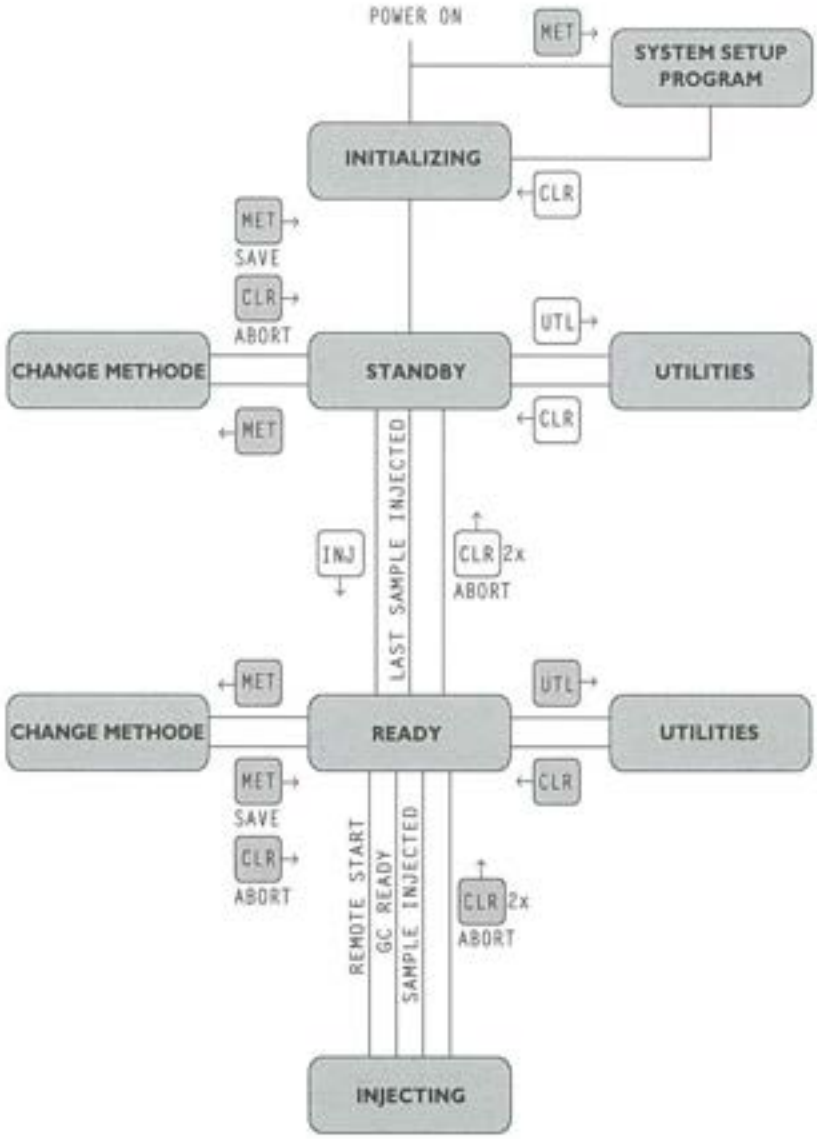
The injection cycle may be aborted in any phase by pressing the CLR key and confirming with a second keystroke. If the syringe is already contaminated or filled, the sample is automatically thrown away, and the syringe is cleaned for the next sampling cycle.

The READY state is changed back to STANDBY after all samples of the selected injection range have been injected, or by pressing the CLR key twice while the autosampler is waiting for the start command.

4.2. Operating States

In the following diagram, the different operating states are represented by circles. The possible changes from one state to another are marked by lines with the associated action next to it. State transitions resulting from host system commands are not indicated in this diagram (see Chapter 6, Remote Control).

Operating States



Characteristics of the different Operating States:

Characteristics of the different Operating States:

INITIALIZING:
Entered when power is turned on or after terminating the System Setup Program. All movements are initialized to home position.

STANDBY:
Entered after initializing, or after an injection range has been processed. All key LEDs are off. On the control terminal screen the first and last sample number of the sampling range, the injection count per sample, and the actual method number are displayed.

READY:
Entered by pressing the INJ key. In this state the A200S is ready to inject the next sample of the injection range as soon as the GC READY line gets active. The LED on INJ key is turned on to mark this state.

INJECTING:
While injecting one sample the autosampler is in the INJECTING state. This state is either entered by a start signal or manually by a single inject command. The sampling cycle may be stopped by pressing the CLR key.

UTILITY:
This state is entered by pressing the UTL key while in STANDBY or READY state. Utility functions are available to inject a single sample, to clean the syringe and to manually inject a sample. The LED on the UTL key is turned on to indicate the state; LEDs on INJ and CLR key are blinking to mark valid input keys (see 4.5).

CHANGE METHOD:
By using the MET key the parameter values of the actual method number are displayed and may be changed. All changes are only valid if this state is left by pressing the MET key a second time. If the CLR key is pressed, the actual method is left unchanged. The LEDs of both keys are blinking in this state. This state may be entered from any other operating state (see 4.3).

Method Parameters

4.3. Method Parameters (see Fig. 7)

An injection method is the set of all parameters specifying the injection cycle. With this concept in mind, it is much easier to change from one application to another requesting a different injection method. There are 9 different methods available, which are maintained even if the power to the A200S is switched off.

Each of the 9 methods contains default values (see Fig. 11). It's also advisable to write down the parameter values of each method. Even though the 9 methods are stored in a battery buffered memory, use the table in Fig. 11 to write down each method! In case of a software update it is possible that all values are reset to default.

The method to be used are selected in STANDBY or SINGLE INJECT state by setting the METH value. The individual parameters of the selected method are checked or changed by pressing the MET key while either in the STANDBY, the READY, or the SINGLE INJECT state. Then the different injection parameters are displayed. Use the MET key to leave the method change program if you want that all changed values are actually saved, or the CLR key to discard all changes made. The MET LED and the CLR LED blink to indicate the valid keys to leave this state.

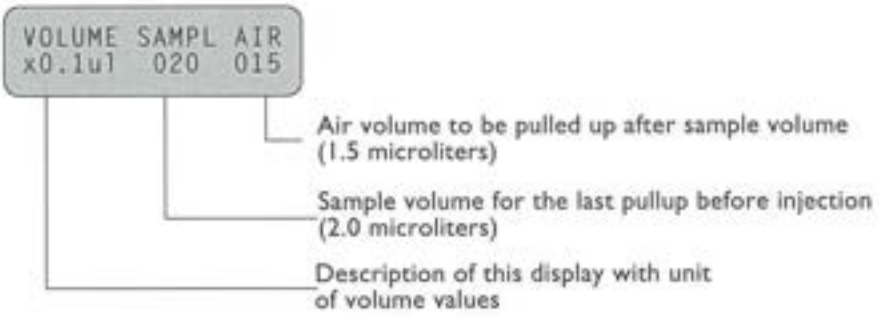
Since there are many more parameters than would fit onto one screen, several screens are used to display the parameters. Pressing the horizontal arrow keys moves through the different screens.

If the method change function is not terminated by pressing either the MET or CLR key within one minute, it is automatically aborted and any changes made have no effect. This is done for safety so that the A200S can not be left for a longer time with a method opened.

Sample and Air Volumes

4.3.1 Sample and Air Volumes

In this display the sample volume to fill the syringe before injection, and the air volume that is pulled up after the needle is moved out of the vial are specified. By pulling up some air after taking the sample, evaporation from the needle is reduced. If multiple filling strokes are selected, these volumes are only valid for the last pull up. The other filling strokes use a separately selectable filling volume (see 4.3.4). If a very small sample volume must be injected, multiple filling strokes ensure better reproducibility. The program checks that the sum of sample and air volume doesn't exceed 10 microliters.

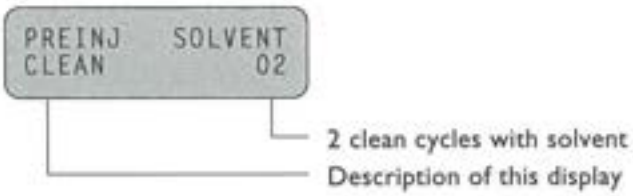


Solvent Wash before Injection

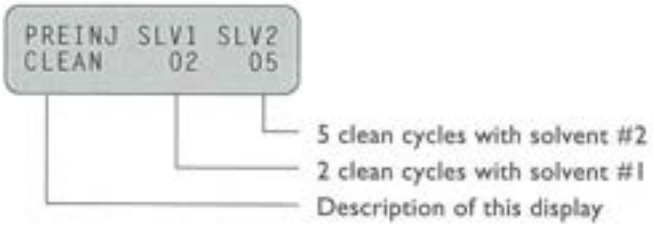
4.3.2 Solvent Wash before Injection

To avoid contamination of the syringe and needle, they may be washed with solvent before the sample is picked up. This helps also to avoid air bubbles below the plunger because the syringe is wet afterwards and is more gastight.

Pre-injection washes are also a possibility to have a solvent plug with the volume of the syringe needle above the sample. After injection the whole sample volume is ejected and only the solvent remains in the needle. If this option is chosen, do not select any pre-injection sample clean cycles or filling strokes!



In the case two solvent/waste vial holders are installed (see 4.6.1, Clean Position), the display looks slightly different:



Clean Cycle with Sample

4.3.3 Clean Cycle with Sample

This option is used when the solvent used in a post injection clean cycle is not compatible with the analysis, or when no pre-injection solvent clean cycle is used. Such a cycle wets the syringe and provides a better seal around the plunger head. Better reproducibility can be achieved.

Warning:

Warning:
Set to zero when pre-injection solvent wash is used and you want a solvent plug on top of the sample to compensate for needle dead volume ! (see 4.3.2)

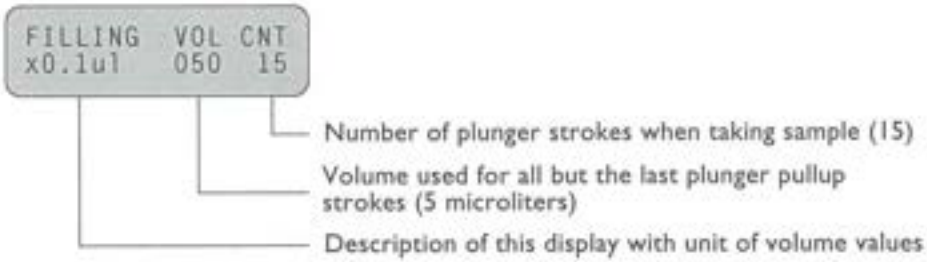
Syringe Filling Volume and Count

4.3.4 Syringe Filling Volume and Count

This parameter serves to control the filling of the syringe. It may happen that some air bubbles remain below the plunger after the first pull up. If the plunger is moved up and down several times, these air bubbles are worked out. With this operation the syringe is completely filled even when using very small sample volumes.

All filling strokes, except for the last one, use the selected minimum filling volume. If the selected sample volume is higher than the filling volume, the

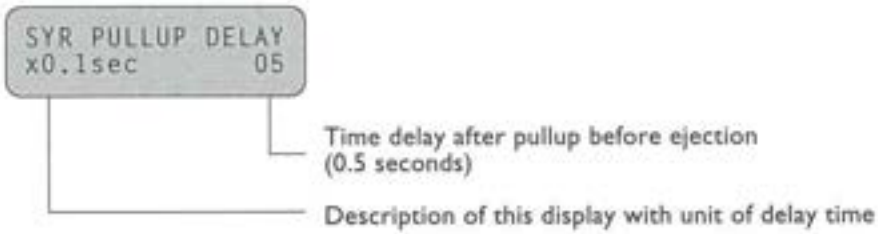
sample volume is used for all filling strokes. If zero is selected as filling count, the plunger is pulled up only once using the sample volume.



Syringe Pullup Delay

4.3.5 Syringe Pullup Delay

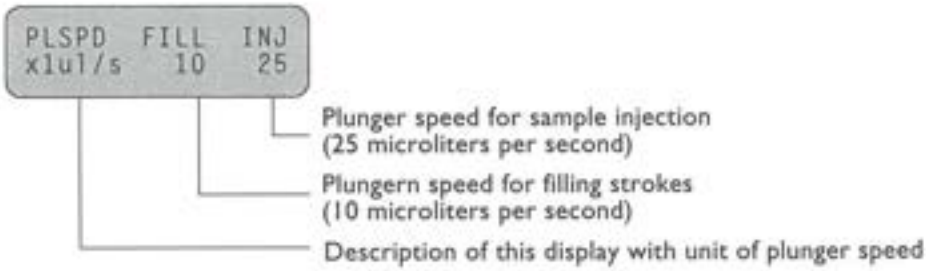
In this display a delay between sample pullup and ejection while filling the syringe is selected. The same delay time is used after the last plunger pullup until the syringe needle is moved out of the vial. It is only used if more than one pullup cycle is selected in the previous display. This feature is especially useful for handling viscous fluids.



Plunger Speed

4.3.6 Plunger Speed

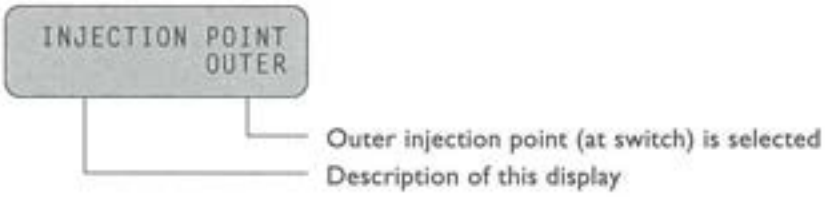
The spewed of the plunger movement can be selected for the filling strokes and for sample injection.



Injection Point

4.3.7 Injection Point

This parameter is only displayed if two injection points are selected in the service program. Switch between OUTER and INNER by using the UP and DOWN key.

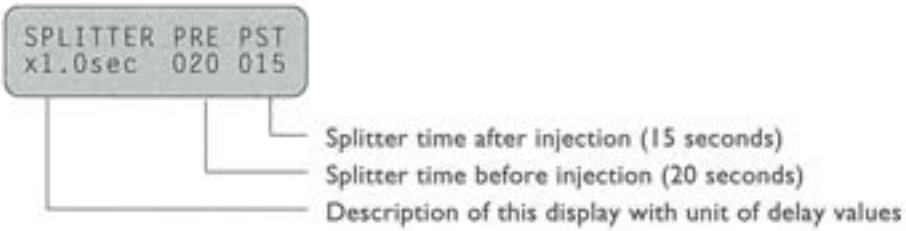


Splitter Valve Control Times

4.3.8 Splitter Valve Control Times

The CTC- A200S makes split/splitless injection possible with gas chromatographs not supporting this feature. An output which controls a valve is activated at a selectable time before injection (PRE), and remains activated until a selectable time after injection (PST). In the systems parameter program you can choose to have the valve engaged or disengaged during this interval (see Chapter 4.6.1. Splitter Valve Active State).

If the PRE time is greater than zero, the valve is activated at the moment the A200S receives the start command. In case the PST time is longer than the A200S takes to get the sample and move to the injection point, the injection is delayed until this time interval has expired. Because the time from the cycle start until the A200S is ready for injection may vary, PRE time should be longer than the maximum injection cycle time. The cycle time until injection depends **on the number of filling strokes** and the number of washing cycles before injection

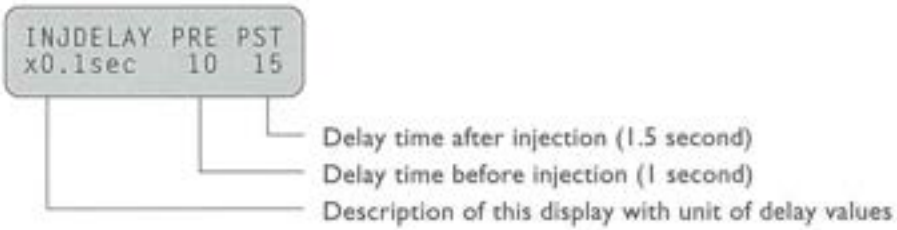


Injection Delay Times

4.3.9 Injection Delay Times

After the needle of the syringe is moved down into the injector of the gas chromatograph, it may be desirable to wait a certain time so that the needle warms up before the sample is injected (PRE) (hot needle injection technique). After the injection it is possible to wait for evaporation of the needle

content before it is pulled out of the injection block (PST). Both parameters might be used for increase in reproducibility.



Cleaning Cycles with Solvent after Injection

4.3.10 Cleaning Cycles with Solvent after Injection

After the sample has been injected the syringe and needle are cleaned by repeatedly filling it with solvent. It is also possible to use two different solvent fluids for special applications (e.g. polar and non-polar or the second is less volatile so the syringe does not dry up).

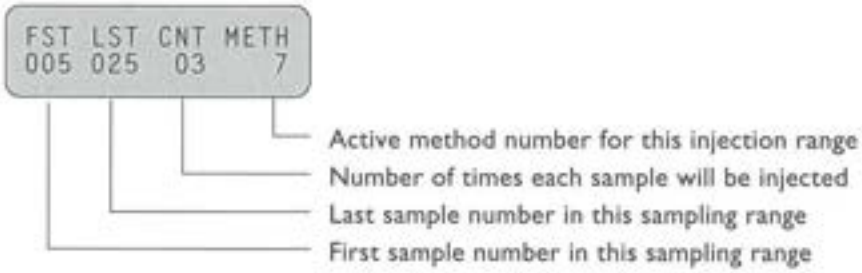
It is possible to clean the syringe with solvent at any time by using the utility function CLEAN SYRINGE (see Chapter 4.5.2). The number of clean cycles selected here is used as default value in the utility program.

Method Run

4.4. Method Run (see Fig. 7)

The range of sample numbers injected automatically, the number of injections per sample, and the injection method used are shown on the control terminal and may be altered while the A200S is in the STANDBY state. All parameters specifying the different modes of injecting a sample are stored in 9 different injection methods. A whole parameter set is recalled by selecting only the appropriate method number. With this feature different injection methods for routine analysis are selected just by choosing the corresponding method number. The user does not have to worry about programming a method before each run.

Example of a control terminal display in STANDBY state:



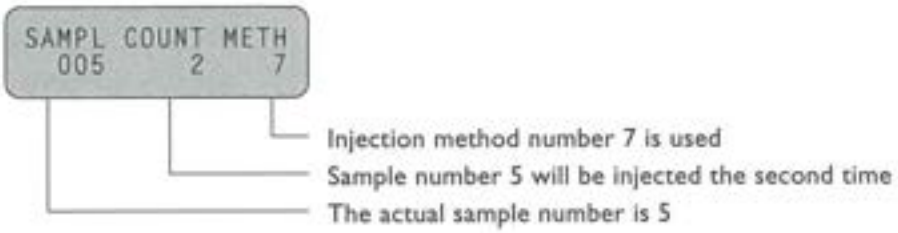
The program checks if the last sample number is equal to or higher than the first one and adjusts the values accordingly.

Before the A200S is ready to automatically inject a range of samples, the following steps described in the previous chapters have to be executed:

- Prepare samples, cap them and insert them into the sample tray
- Select sample range, injection count per sample and injection method
- If necessary set the injection parameters of the selected method
- Insert syringe into the injection head
- Adjust dead volume of syringe by pushing down the plunger holder
- Fill wash solvent vial with appropriate solvent
- Rinse syringe by starting a cleaning cycle using the utility function CLEAN SYRINGE (see section 4.5.2 and Fig. 7)

To start injection the INJ key is pressed. The operating state is changed from STANDBY to READY and the LED on the INJ key is lit to indicate this state.

The display indicates the next sample number to be injected, the actual injection count of this sample and the number of the injection method being used.



As soon as the START INJECT command is received the autosampler starts the injection cycle for the sample number indicated. The start command is either an activation of the GC READY input or a start command sent from the connected host system. The active mode is selected in the System Setup Program (see Chapter 4.6.1, Start Signal Source and Fig. 8).

If for any reason the running injection cycle has to be stopped, press the CLR key. This doesn't stop the cycle immediately. The actual movement finishes, then the A200S stops and the following message appears on the control terminal display:

Press again the CLR key to abort this injection cycle or proceed with the INJ key. If the cycle is aborted, the actual sample is skipped.

Utilities

4.5. Utilities (see Fig. 7)

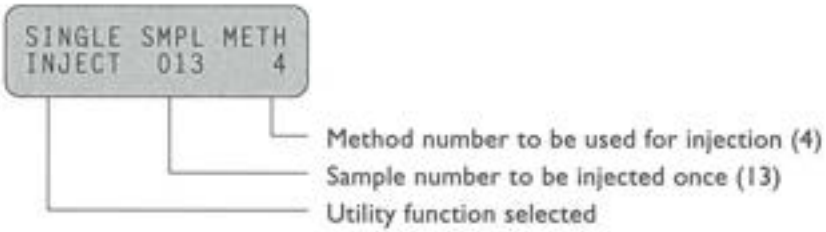
Besides the standard operation of the A200S, several special functions are available. All these utility functions are activated by pressing the UTL key while either in the STANDBY or READY state. The functions to be executed are selected by using the RIGHT or LEFT key until the desired function is displayed on the control terminal screen. Several functions need parameters. Their value is selected by using the UP or DOWN key as usual.

Single Injection

4.5.1 Single Injection

Sometimes the user wants to inject a single sample during a run without interrupting that run. In the single inject mode a sample and method number can be freely selected, and this sample will be injected once.

- Press UTL key to enter utility functions
- The INJ and CLR LEDs flash, and the following message is displayed on the screen:



Sample and method number default to the values that would have been used at the next automatic injection cycle.

- Select sample and method number by using LEFT and RIGHT keys.
- Arm the sampler for the next start signal by pressing the INJ key.

- If the GC READY signal hasn't been activated, the following message is displayed:

For special cases the sample may be injected without waiting for the GC to be ready. Press the INJ key a second time and the cycle starts immediately, ignoring the state of the GC READY line.

- After the injection cycle has terminated the A200S returns to its previous state (STANDBY or READY).

Cleaning Syringe

4.5.2 Cleaning Syringe

The syringe is cleaned with solvent after an injection if the parameter CLEAN SOLVENT in the actual method is greater than zero. If the operator wants to clean the syringe for a selected number of cleaning cycles, e.g. before the injection cycle is started or after a new syringe has been installed, this utility function can be used.

- Press UTL key to enter utility functions.
- Press RIGHT key twice to get to the CLEAN SYRINGE function.
- The INJ and CLR LEDs flash and the following message is displayed on the screen:

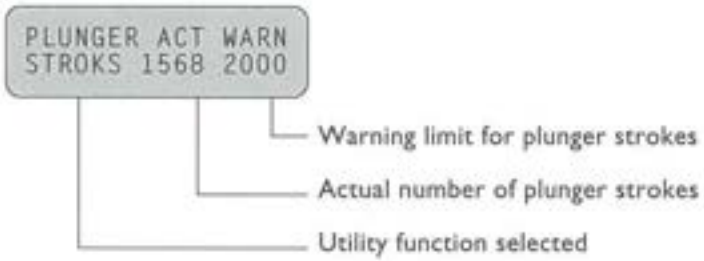
The number of cleaning cycles to be executed defaults to the number stored in the actual method, but may also be changed here.

- Pressing the INJ key starts the cleaning of the syringe. The remaining cycles are displayed in place of the total clean cycle count.
- The CLR key aborts cleaning after the running cycle has been terminated.

Plunger Stroke Count

4.5.3 Plunger Stroke Count

The syringe plunger shows some abrasion and may jam after a certain time. To avoid operating failures the plunger and syringe must be cleaned periodically. The maintenance interval is dependant on the number of plunger strokes executed. It is difficult to keep track of this number because it depends not only on the number of samples injected but also on the method parameters selected (filling strokes, cleaning cycles). With this utility function a warning limit may be specified. Also the actual number of strokes executed is displayed.



When the processing of a sample range is started and the actual count exceeds the operator will be warned with following message:

Take out the syringe and clean it as advised by the syringe manufacturer. Pressing INJ after re-inserting the syringe resets the actual count. Press CLR if you don't want to clean the syringe at this moment - the actual count is not cleared and the warning reappears at the next start.

To enable this feature, PLUNG STROKE CNT in the system parameters must be set to ENABLED (see 4.6.1).

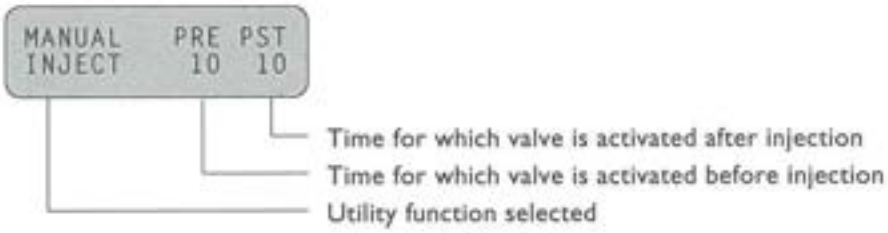
Manual Injection

4.5.4 Manual Injection

The A200S supports the control of a valve for split/splitless injection. The MANUAL INJECT utility function enables manual injection directly into the column with the control of the splitter valve by the A200S. Two time intervals are specified, the time the valve is activated before injection and the time the valve is activated after injection. The injection time is indicated by a buzzer tone so that the user can concentrate on the injection process.

- Press UTL key to enter utility functions.

- Press RIGHT key three times to skip SINGLE INJECT and CLEAN SYRINGE functions to get to the MANUAL INJECT function.
- The INJ and CLR LEDs flash and the following message is displayed on the screen:



Time before and after injection is maintained and is not dependent on the values in the current method.

- Arm the A200S for the next start signal by pressing the INJ key.
- If the GC READY signal has not yet been activated the following message is displayed:

For special cases the sample may be injected without waiting for the GC to be ready. Press the INJ key a second time and the splitter timer is started immediately.

- The PRE time begins to count down. The buzzer beeps at two seconds and one second before PRE time is zero.
- At PRE time zero the buzzer beeps for a longer period to signal that the sample must be injected now. The PST time begins to count down.
- The operator injects the sample.
- At post time zero the splitter valve is deactivated and the buzzer beeps again to mark termination of the manual injection cycle.
- After termination of the timing cycle the MANUAL INJECT function is still active so that several injections may be done without calling the function every time. Exit the function by pressing the CLR key.

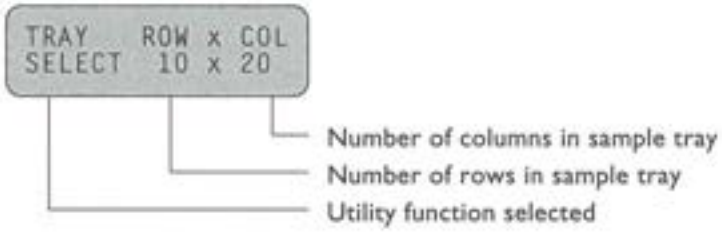
  If the CLR key is pressed during the timing cycle, the splitter valve is deactivated and the timers are reset.

Tray Selection

4.5.5 Tray Selection

As an option three different sample trays are available for the A200S. To use different trays the tray selection mode in the System Setup Program must be set to MANUAL (see Chapter 4.6.1. and Fig. 8, Tray Selection Mode). Then use this utility function to select between the different tray sizes.

- Press UTL key to enter utility functions.
- Press LEFT key once to get to the TRAY SELECT function.
- The CLR LED flashes and the following message is displayed on the screen:



- Select the actual sample tray by using the UP or DOWN key.

WARNING:

WARNING:
Selecting a different tray than is actually used will damage the syringe needle. The A200S does not check if the correct tray is inserted.

System Setup Program

4.6. System Setup Program (see Fig. 8)

To start the System Setup Program proceed as follows:

- Turn off main power switch.
- Press the MET key and turn on power again while still holding down the key.
- As soon as the following message is displayed the System Setup Program is started

SET PARAMETERS	(BLINKING)

- Release the MET key

The blinking indicates that this function has not yet been selected. To select the desired function:

- Press LEFT or RIGHT key until the desired function appears in the display (still blinking)
- Press INJ key to actually select the function. Either the function name remains on the display (blinking stopped) or a special function related message is displayed.
- Leave the function by pressing the CLR key. The function name blinks and another function may be selected by using LEFT or RIGHT keys.

The System Setup Program is abandoned by pressing the CLR key while no function has been selected.

The control terminal keys have special meanings according to the selected function. The arrow keys are often used to start a movement in the corresponding direction, and the INJ key to store a position or start an action (like a computer's ENTER key). The CLR key always terminates the selected function.

Figure 8 shows a graphic representation of the System Setup Program. In order to get oriented about the location of the various functions, this figure should be helpful. Following are descriptions of the individual functions.

Set Parameters

4.6.1. Set Parameters

The A200S is adaptable to a wide range of gas chromatographs and applications. This makes it necessary to set some parameters to select the proper operating mode. After selecting SET PARAMETERS function by pressing the INJ key, the LEFT and RIGHT keys move through several displays to show the different parameters (see Fig. 8).

Injection Side

Injection Side

The A200S may be converted to either left or right hand injection. The program must be set to the injection side that is mechanically set up so that it can operate properly. See chapter 3.2 for instructions to change injection side

Select either 'LEFT' or 'RIGHT'

Clean Position

Clean Position

The solvent and waste vials can be positioned in two different places on either side of the sample tray: HOME POS SIDE or INJECTION SIDE. It is also possible to use two solvents for syringe cleaning. If BOTH SIDES or DBL HOME SIDE is choosen, there will be prompts in the method menu for Solvent 1 and Solvent 2. Selection of DBL HOME SIDE requires a special solvent /waste vial holder and the terminal must either be mounted on the injection side or outside of the mounting flange.

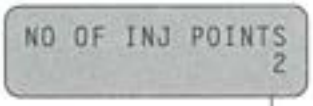
Wash/waste vial holder is mounted on terminal side

Number of Injection Points

Number of Injection Points

Sometimes it is necessary to alternatively inject at two different positions into the GC. If two is selected for this parameter, this feature is enabled. The injection method then contains one additional parameter which selects

the inner or outer point for injection. With the Expert Programming Software Options enabled, selecting two injection points enables dual and double injection modes.



Select 1 or 2 injection points

Second Injection Point Position

Second Injection Point Position

This parameter is only displayed if NO OF INJ POINTS is two. Select the horizontal distance between the two injection points in tenth of millimeters. The position of the inner injection point is defined relative to the outer point. Only the outer point is adjusted by using the limit switch (see Paragraph 4.6.5, Adjusting Injection Point).

Distance between inner and outer point is 45.5 mm

Start Signal Source

Start Signal Source

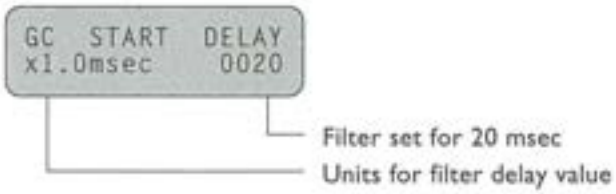
An injection cycle may be either started by a contact closure or logic signal from the GC or by a message sent from a remote control system. Select the corresponding signal source as GC READY or REMOTE.

Possible are GC READY or REMOTE

GC Start Delay

GC Start Delay

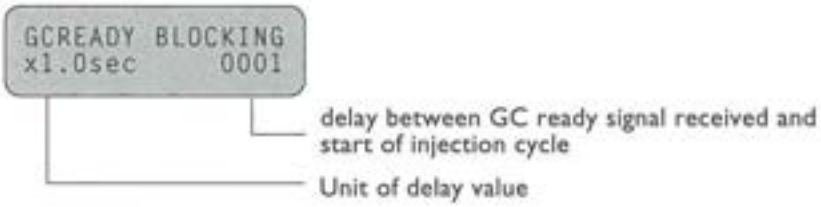
In case it is not possible to receive a clean GC-Ready signal, or false signal spikes cause the autosampler to start with an injection cycle, this option acts as an additional „filter." The length of time (10 msec - 1 sec) that is selected allows the autosampler to start an injection cycle only if a signal lasts at least for the time set.



GC Ready Blocking

GC Ready Blocking

This feature is useful again when interfacing with equipment that produces a GC or system ready signal too early for an injection cycle to start. Typical examples are : Non-true GC ready signals (temperature not stabilized), data system not ready because printer still in operation, etc. The delay range is from 1 sec to 9,999 sec (approx. 166 minutes).



Tray Selection Mode

Tray Selection Mode

If more than one sample tray type will be used alternately the tray selection mode must be set to MANUAL. This enables the utility function TRAY SELECT.

Tray Selection

Tray Selection

If TRAY SELECT MODE is set to DISABLED the utility function TRAY SELECT is disabled. The type of tray that will be used must be selected here. In case different trays are used, the current tray type being used for setup of sample penetration is selected (see 4.6.4., Adjusting Sample Penetration Depth).

Select 10x20, 7x15 or 4x8 vials

Vial Detection Switch

Vial Detection Switch

In some cases it is desirable to keep the autosampler working in sequence through the whole range of samples rather than skipping empty vial positions. If the vial detector is off, the autosampler will go through a complete injection cycle procedure even though the vial is missing. It must also be set to OFF if the BCD vial number is activated at Ready State to prevent reading a wrong number if a vial is missing.

Vial detection is enabled

Splitter Valve Active State

Splitter Valve Active State

If the splitter valve output is used the state of the valve output while not injecting a sample is selected to be either activated (ON, 24V AC on splitter valve connector) or de-activated (OFF, output open).

Select 'LOW' or 'HIGH'

Ready Signal Active State

Ready Signal Active State

When the autosampler is ready to accept a start signal a relay is activated (see 4.2, Operating States). Select here if the ready state is represented by an open or closed contact.

Relay contact for RDY output is closed when sampler is ready for injection

Injected Signal Active State

Injected Signal Active State

When the autosampler injects a sample it sends a start signal to the GC or data system. A volay contact is activated at injection time. Setting the value to closed means the contact will be closed at injection time.

INJ reelay contact is closed at injection time

BCD Output Active State

BCD Output Active State

The logic used for sending sample numbers through the BCD output is selected here (the optional BCD-board needs to be installed).

Select 'LOW' or 'HIGH'

BCD Activation Time

BCD Activation Time

There is a choice of having the vial position counter incremented when the ready signal is received or when an injection is done. Dependent on when the vial position number is requested, one or the other setting has to be chosen. If increment is requested at ready state the vial detection should also be set to OFF. So prevent reading a wrong vial number if a vial is missing.

The BCD number of the injected sample is activated after injection

Buzzer Start Cycle

Buzzer Start Cycle

A buzzer is built into the A200S. This parameter enables or disables the activation of the buzzer before an injection cycle.

Select 'ON' or 'OFF' to enable or disable the buzzer

Buzzer Manual Injection

Buzzer Manual Injection

The timer signal is disabled if this parameter is set to OFF. This feature affects the manual injection, selected through the Utilities function (see 4.5.4, Manual Inject)

Select ON or OFF

Adjusting Vial Position

4.6.2. Adjusting Vial Position

Function display:

(BLINKING)

This function is used to adjust the limit switches to centre the needle in the vial position and detect that the injection unit is at WASTE position, the sample tray is at row 1 and a sample vial is inserted. Check if the right sample tray is selected (see 4.6.1) befor making adjustments. After activation the following display appears:

state of sample vial detection switch

The keys have the following meanings in this function (for left hand injection, for right hand injection LEFT and RIGHT keys change their function):

- [←] Move injection head to sample position on the opposite side of WASTE position
- [→] Move injection head to limit switch on WASTE position
- [↑] Move sample tray to limit switch on row number 1
- [↓] Move sample tray to last row
- [CLR] Terminate this function

Waste and Sample Vial Position

Waste and Sample Vial Position

The distance between WASTE position and sample tray is fixed. By shifting the limit switch at the WASTE position to the left or right the position of the injection unit relative to the sample vial is adjusted. Proceed as follows to adjust the WASTE position switch:

1. Insert vial into sample tray.
2. Select the right tray type in use (see 4.6.1).
3. Remove upper holding screw (Pos. 13, Fig. 4) of control terminal and loosen the lower one. Turn down control terminal to get access to the dust cover.
4. Remove the two screws holding the crossrail dust cover.

5. Move injection head to vial by pressing LEFT key.
6. Check position of injection unit relative to vial.
7. Shift the limit switch for the difference between injection unit and vial position to the opposite side.
8. Move injection head to WASTE position and back to vial by pressing LEFT key
9. Recheck adjustment between injection head and vial, and repeat steps 7 and 8 until adjustment is satisfactory.

Sample Tray Position

Sample Tray Position

The sample vial position in the Y-direction is adjusted by shifting the tray switch activator (Fig. 3, Pos. 26) on the left side of the sample tray. To get better access to the screw holding the switch activator the cooling plate (27) is moved out by using the DOWN key. The procedure to adjust this activator is as follows:

1. Insert vial into sample tray.
2. Move injection head to vial by pressing LEFT key.
3. Check position of injection head relative to vial.
4. Move injection head to WASTE position by pressing RIGHT key.
5. Move sample tray to last row by pressing DOWN key.
6. Adjust switch activator according to the difference detected.
7. Move sample tray back to row 1 by pressing UP key.
8. Repeat steps 2 to 7 until adjustment of injection head is satisfactory.

Sample Detection Sensor

Sample Detection Sensor

The A200S can detect whether a vial is inserted in the selected sample number position. This is done by checking how deep the needle guide moves when the syringe unit moves down to get the sample out of the vial. If no vial is inserted, the guide moves down to the sample tray and the switch is not activated. The state of this switch is indicated on the display. The adjustment is checked as follows:

1. Insert a vial one hole inside the outermost sample position on injection side.
2. Move injection unit to sample tray by pressing LEFT key. The needle guide moves down to the sample tray because no vial is present.
3. Shift the vial holder up slowly and check the switch indication on the display. It should be OFF at the beginning, turned to ON when the holder is about 3 mm below the vial's upper rim and switch back to OFF when the holder is about 3 mm above the vial.

Wash Penetration Depth

4.6.3 Wash Penetration Depth

Function display:

(BLINKING)

The downward movement of the syringe when pulling up solvent and dispensing solvent, is individually selectable.

The keys have the following meaning in this function (for left hand injection, for right hand injection LEFT and RIGHT keys change their function):

←	Move injection head to solvent vial
→	Move injection head to waste vial
↑	Move syringe up to limit switch
↓	Move syringe down one step (keep pressing to move several steps)
UTL	Move syringe down about 3 mm
INJ	Store the present position of syringe
MET	Move syringe up to limit switch and then down to stored position to double check the stored position
CLR	Terminate this function

Proceed as follows to set the solvent and waste penetration points:

1. Insert solvent and waste vials.
2. Move injection head to solvent wash vial by pressing LEFT key.
3. Move syringe down in large steps by using UTL key and small steps by using down key. Leave some safety clearance for differences in vial bottom thickness.
4. The syringe may not be moved upwards by single steps. If it is moved down too far, use UP key to move up to the limit switch and start again.
5. When the desired bottom point is reached, press INJ to store this position.

6. Check the set position by pressing the MET key. This moves the syringe up to the limit switch and then down to the stored position.
7. Press RIGHT key to move injection unit to waste vial.
8. Repeat steps 3 to 6 to set waste vial penetration.

Warning:

Warning:
Any penetration depth can only be approached from a downward motion (use UTL or DOWN key). No upward adjustment is possible. If you are at a position that is too low, use UP key to start over from the top. Don't forget to store position with INJ!

Sample Penetration Depth

4.6.4 Sample Penetration Depth

Function display:

(BLINKING)

When working with very small amounts of sample it is necessary that the syringe needle moves down into the sample vial as deep as possible when taking a sample for injection. On the other hand the needle must not touch the base of the vial to avoid bending of the needle tip. This point is adjusted by moving the needle down step by step while checking the needle position through the hole on the front side of the sample tray . When the bottom is reached the position is stored for the actual sample tray by pressing INJ. Each sample tray has its own sample penetration value. Adjust the depth for every tray used by first selecting the tray type with function SET PARAMETERS - TRAY SELECT and then proceeding as outlined in this chapter.

The keys have the same function as when setting wash penetration except that the LEFT key moves to a sample vial instead of the solvent vial. (see 4.6.3 for key function definition).

Proceed as follows to set the sample penetration point:

1. Insert vial into sample tray.
2. Move injection head to vial by pressing LEFT key.
3. Move syringe down in large steps by using UTL key until the needle is visible through the hole in front of the sample tray.
4. Move further down by using DOWN key until the needle reaches the bottom of the vial. Leave some safety clearance for differences in vial bottom thickness.

5. The syringe may not be moved up by single steps. If it is moved down too far, use UP key to move the syringe to the limit switch and start again with step 3.
6. When the bottom point is reached, press INJ to store this position.
7. Check the set position by pressing the MET key. This moves the syringe up to the limit switch and then down to the stored position.

Injection Point

4.6.5 Injection Point

Function display:

(BLINKING)

This function is used to adjust the outer injection position of the injection unit and to set the penetration depth of the needle when injecting into the GC.

Injection Position

Injection Position

For safety reasons the injection unit is not moved to the injection point by counting steps. Instead, a limit switch is used to detect this position. The switch is adjusted as follows:

1. Remove the two screws on injection side (Fig. 4, Pos. 49) holding the crossrail dust cover to get access to the limit switch at the INJECT position.
2. Move injection head to inject position by pressing LEFT key.
3. Move down the needle guide by using UTL and DOWN keys to the injection point so that the adjustment to the left and right may be checked.
4. Move injection head back to WASTE position by using RIGHT key to get access to the limit switch holding screw. If two injection points are selected, the injection unit moves to the inner point.
5. Shift the limit switch for the detected difference to the opposite side.
6. Repeat steps 2 to 5 until the adjustment is satisfactory.
7. Tighten the limit switch holding screws and fix the crossrail dust cover.
8. Check position of the inner port setting (X-DIFF) and adjust accordingly (see 4.6.1.).

Injection Depth

Injection Depth

The needle penetration into the injection block of the GC may be adjusted to any value by using the following procedure. The key definitions are the same as in Wash Penetration Depth, except that the LEFT key moves to the injection point instead of the solvent vial (see 4.6.3).

1. Move the injection head to the injection point by pressing LEFT key.
2. Move the syringe down in large steps by using UTL key.
3. Continue moving down with DOWN key until the syringe needle penetrates as desired into the injection block.
4. Press INJ to store this position.
5. Check the stored position by pressing the MET key.
6. If two injection points are selected, press RIGHT key to move to the inner point and repeat steps 2 to 5. The depth is stored separately for both points.

Checking Connection to Remote System

4.6.6. Checking Connection to Remote System

Function display:

(BLINKING)

It is possible to control the A200S by a remote system connected to the RS232 serial port. Selecting the proper physical format of an RS232 connection (number of data and stop bits, parity, baud rate) and connecting the right pins on the interconnection cable can be very time consuming. A simple connection check is very helpful.

For this test an ASCII terminal or a computer using a terminal emulation program is connected to the RS232 port. It has to be set to the following data format:

8 data bits
1 stop bit
no parity
9600 bits/second

Terminal and A200S are connected by pins 2, 3 and 7 only. The A200S has its sending line (Tx) on pin 3, and the receiving line (Rx) on pin 2. The terminal must not use hardware handshake signals, or the requested handshake signals have to be short circuited in the terminal connector (usually pin 20 to pin 5 and 8).

To start the test, press the INJ key. All characters typed in at the connected terminal are displayed on the control display and are echoed back to the sending terminal. If every typed character appears on both the A200S display and the terminal screen, the following points are checked:

- Connection between A200S and terminal
- Terminal RS232 data protocol setup
- Communication part of the sampler hardware

If this doesn't work as described, there is a possibility to check the A200S' sending line separately. Press the INJ key on the control unit. This sends some text to the connected terminal. If it appears on the terminal's screen, the A200S' sending link is working and the trouble must be within the receiving path.

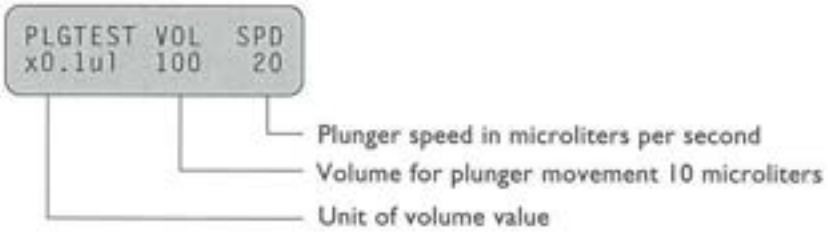
Checking Plunger Operation

4.6.7. Checking Plunger Operation

Function display:

(BLINKING)

This function is used to check the operation of the plunger drive motor, the setup of dead volume, and the movement of the plunger. After the plunger check function is selected, the following display appears:



The equivalent volume for the plunger movement is changed by using UP and DOWN keys. Pressing the INJ key starts measurement of the dead volume and moves the plunger up to the selected volume. The second activation of the INJ key moves the plunger back down to zero volume.

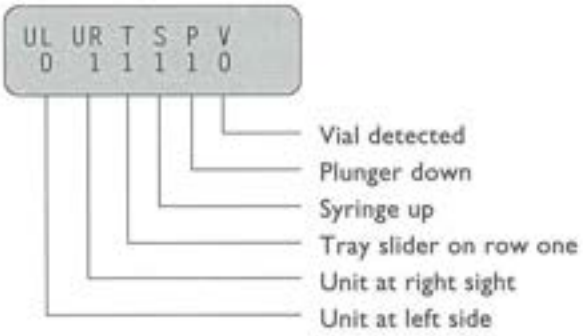
Checking Limit Switches

4.6.8. Checking Limit Switches

Function display:

(BLINKING)

This function is used for maintenance purposes. The state of all limit switches is displayed on one screen:



0: Switch not activated

1: Switch activated

Setting Motor Speeds

4.6.9. Setting Motor Speeds

Function display:

(BLINKING)

The speed of syringe and plunger movements at different states of the injection cycle is selectable. The default values setup has proven to be optimum, and should only be changed if really necessary.

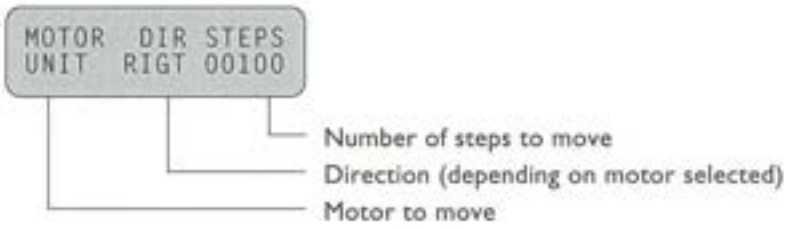
Enter this parameter menu by pressing INJ. Use LEFT or RIGHT key to get to the motor (motion) to be changed. The indicated value is a delay time between motor steps. Therefore a higher value means a slower speed, etc. It is advisable that you make a note of speeds that were found to be most appropriate for each method. Fig. 11 provides a table where values changed from default can be noted.

Checking Motors

4.6.10. Checking Motors

Function display:

(BLINKING)



Possible motors with corresponding directions are:

UNIT	LEFT - RIGHT
TRAY	FORWARD - BACKWARDS
PLUNGER	UP - DOWN
SYRINGE	DOWN - UP

Limit switches are not checked if this function is used to move a motor.

WARNING:

WARNING:
Do not leave the A200S with this function activated because overheating of the motor drive circuit may result.

Resetting To Default Values

4.6.11. Resetting To Default Values

Function display:

(BLINKING)

With this function all changeable parameters are reset to a default value (see Table in Fig. 11). All user set values are lost. BE CAREFUL WHEN USING THIS FUNCTION. Its only use is to reset all parameters to a save value after making changes. (e.g. sample penetration depth too deep so that the syringe needle may be damaged.) Use this function if the A200S is reinstalled on another GC before setting up new values.

```
ARE YOU SHURE ??
"INJ" TO CONFIRM
```

Abort if you have inadvertendly selected this function by pressing the CLR key

If you are sure that you want to reset all parameters, including injection methods, confirm by pressing the INJ key. The program now enters a cold start routine and it looks as if the A200S lost its parameters due to a weak backup battery or a hardware failure. Confirm the following messages with the INJ key, and the program enters the service program again.

```
WARNING: SAMPLER
SETUP LOST
```

```
CHECK BATTERY ON
CPU MODULE
```

```
OPERATING VALUES
ARE RESET
```

```
SET PARAMETERS
```

(BLINKING)

Now you can proceed by selecting sampler operating modes and setting up parameters as described in the previous paragraphs.

5. Maintenance and Service

Maintenance

5.1. Maintenance

The required routine maintenance operations are explained below.

Daily

5.1.1. Daily

- Check wash solvent level, empty waste vial if needed!
- Clean syringe plunger as recommended by syringe manufacturer.
- Before a first run after several hours of interrupted operation perform 3-5 wash cycles to condition the syringe by using UTL function CLEAN SYRINGE.

Weekly

5.1.2. Weekly

- Check wash solvent and waste vial septum, best if replaced every month.
- Check syringe, might have to be replaced every 2-3 months depending on use.

Service

5.2. Service

Almost all problems that could occur with the CTC A200S autosampler can be fixed by the end-user. The modular design allows technically inclined people to troubleshoot and exchange modules with the help of trained professionals associated with authorized dealers of the manufacturer. This chapter covers the troubleshooting approach and two levels of interventions for correcting a problem. In general Minor Services Cases don't involve much more than a hardware or software adjustment. In a few cases that could involve exchanging a readily accessible part. Major Service Cases involve exchanging modules, or require dismounting of a module and exchange of parts hard to reach.

Troubleshooting

5.2.1. Troubleshooting

Symptom:
No reaction by the instrument when powering up

1. Check power connection (fuse for AC outlet, power cord)
2. Check line voltage setting at AC power connection box (36)
3. Check fuse in AC power connection box (36)
4. Check flat cable connections (to control terminal and injection head)
5. If 1 - 4 does not reveal the source of the problem, call for service!

Symptom:
Error message: Warning: Sampler Setup Lost

This message is displayed if the checksum calculated over all system values in non volatile memory is bad. This may be caused by a week battery on the control module or if the control program (EPROM) has been updated to a new version.

1. If you have changed control software ignore this message and proceed with INJ key. Restore system parameters and injection methods.
2. If control software has not been changed, call for service to replace backup batteries (59) on control board (48).

Symptom:
Error message: Switch not detected

Every time a motor moves towards a switch, the distance moved is checked against the maximum possible travelling distance. If the switch is not activated after this distance either the switch is defective or the motor does not move due to a mechanical or electronic failure.

1. Check if the tray home switch activator (26) is not adjusted too far backwards so that the tray drive blocks mechanically before the switch is activated. This may happen intermittently and only if the sample tray is inserted.
2. Check if flat cables to injection head (15) and control terminal (14) are firmly connected on both sides.
3. Check if switch cable plug (46) is firmly seated in the socket on the processor board.
4. Check if cables to the tray (55) and cross motors (57) are firmly connected.
5. Move injection head over to the injection port area, move syringe carrier down and plunger holder up. When powering up, first the syringe carrier pulls up, then the injection head moves across to its home position, then the tray initializes, and last the plunger. Notice what gets initialized before the error message shows. In this manner the drive that causes the problem can be identified.
6. Check switches by entering System Parameter Program (see 4.6.8 and Fig. 8). By moving the injection head all the way to the left and to the right, the switch status will change (0=OFF; 1=ON). In the same way, the syringe, vial and plunger switch can be checked for proper functioning.
7. Check motors by entering System Parameter Program (see 4.6.10 and Fig. 8)
8. Check fuse on the processor board (44). If this fuse is broken there is normally also a problem with a stepper motor driver and the control board has to be replaced (see 5.2.2).

Symptom:
Error message: Switch always closed

Similar case as above but the switch remains activated. Follow same error checking.

Warning:

Warning:
The processor board fuse is connected to the stepper motor drivers. It is possible that a driver has been damaged anyway! Never change that fuse with the instrument powered. Never power up the instrument without the fuse in place!

Symptom:
Error message: ERROR #n

This message indicates a software error and should never happen.

1. Switch the unit off and on again, then write down all method and system parameter. Settings using table in Figure 11.
2. Reset all values to default using the Service Program (see 4.6.11).
3. Reinstall system and method parameters from table in Figure 11.
4. If the error happens again call your dealer for support. Report software revision number (indicated for some seconds on the display when power is switched on) and your method and system parameter setup.

Symptom:
Injection head picks up vials

1. Check if the syringe needle is completely retracted into needle guide (4) when in its home position and under power. Touch with your finger the underside of the needle holder. If the needle tip can be detected, the needle is not fully retracted.
2. If not fully retracted check length of the syringe needle used - nominal length is 51 mm (2"). Use procedure in 5.2.2 for adjusting the needle guide position if the needle length is OK.

Symptom:
Autosampler seems to skip samples

If skipping samples is an intermittent problem, it is most likely that you are using vials that are too long or too short so that the vial detector does not function properly for every vial.

1. Measure your vial height. The vial detector is adjusted by the manufacturer to detect vials having a height as indicated in section 2.5.
2. If you need to use shorter vials adjust the vial detection switch (see 5.2.1) on top of one of the needle guide rods and follow section 4.6.2 for adjustment.

Symptom:
The injection head goes to the first vial, but immediately returns back to the home position after lowering the syringe carrier onto the top of the vial

This is the same problem as above with last sample of injection range set equal to first sample.

Symptom:
Injection head moves to wrong X-position when picking up sample or solvent

1. Check if the right vial tray is selected either in System Setup Program (just one tray in use and tray select mode set to DISABLED, see 4.6.1) or in utility function TRAY SELECT (see 4.5.5).
2. Check if the set screw of the toothed pulley on the cross motor (28) is tightened. A loose pulley gives strange positioning errors because home and injection point are detected by switches and the positioning problem may only be noticed at sample and solvent pickup.

Symptom:
Does not hold syringe needle penetration depth after adjustment (solvent, waste, sample, inject position)

A common error is that the adjusted penetration depth is not actually stored with the INJ key and the old depth is remained. Follow descriptions in section 4.6.3, 4.6.4 and 4.6.5 to adjust penetration depth at solvent, waste, sample and inject position.

Symptom:
Does not start sample injection cycle

The start signal for a sampling cycle may come from two different sources: A GC Ready signal connected to the GC input connector (37) or a start command sent from a remote control system via the RS232 connection (38). Which one is active depends on your installation.

1. Check setting of start signal source (see 4.6.1) depending on your installation.
2. If GC Ready start signal is active or the remote start command without a sample and method number is used (# 990000CR), the sampler must be in the Ready state to accept the start signal, i.e. the INJ LED is lit and the next sample number is displayed (see 4.2 and 4.4).
3. If GC Ready start signal is used, check values for GC Start Delay and GC Ready Blocking (see 4.6.1). Disconnect the GC interface connector (37). Switch on the autosampler and change to Ready state by pressing INJ. Connect pins 7 and 8 at the GC interface connector. If the sampler starts an injection cycle, the error must be within the connection to the GC. If it does not start, check cable connection from GC interface plug to the control board (58). If it is OK, exchange the control board.
4. If remote control start is used, check the connection to the host system using a terminal emulation program on the host side. Refer to section 4.6.6 for instructions.

Symptom:
Excessive noise from syringe plunger or any other drive

1. Turn the instrument off and check if syringe plunger, syringe carrier or injection head (X-slide), when being moved by hand, let you feel any resistance. If smooth and even movement results there is no indication that any of the motors are faulty or any excessive mechanical resistance exists.
2. Since certain frequencies of the stepper motors can cause a resonance in the different instrument parts, change the speed of the motor, where the noise originates. A change up or down will most likely eliminate the noise problem. It should be noted that this problem, even though it is a nuisance, will not hurt the instrument.
3. In case step #2 does not remedy the problem, call for service help.

Symptom:
Syringe does not fill properly (air bubbles below plunger)

1. Try to increase number of filling strokes to work out air bubbles.
2. Check the syringe needle tip. If it is bent (tip looks like a hook), change the syringe. Any restrictions, which can easily be caused by a burred or bent needle tip, will cause excessive pressure differences that cannot be equalized with normal parameter settings. Use preferably a syringe with a solid style needle tip (side port or through port).
3. If you are using high volatile solvents use a gastight syringe.
4. Check sample penetration depth (see 4.6.4) if the needle tip is below the liquid level. If sideport or throughport needles are used, check that the side hole is also within the liquid.

Symptom:
Results show no or very low detector signal (no peaks)

A clogged syringe needle might be the reason for very low or even no detector signal. Coring of soft septa or picking up sediment on the bottom of the vial have often turned out to be the problem.

1. If you are using very low sample volumes check sample penetration depth (see 4.6.4). Adjust to a deeper level if necessary, but do not touch the vials bottom with the needle tip to avoid bending of the tip.
2. Check the syringe needle tip. If it is bent (tip looks like a hook), change the syringe. Any restrictions, which can easily be caused by a burred or bent needle tip, will cause excessive pressure differences that cannot be equalized with normal parameter settings. Use preferably a syringe with a solid style needle tip (side port or through port).

3. Switch to a different vial septum, if possible to silicon rubber that's Teflon coated on the under side.
4. Check that the method you are using has the proper sample volume entered (The incremental unit is 0.1 µl. Set value to 10 for 1 µl)

Symptom:
Results show lower reproducibility than normal

1. Use enough cleaning cycles after injection to assure a clean syringe. Use cleaning cycles before injection if you are using a low volatile solvent.
2. Check the syringe needle tip. If it is bent (tip looks like a hook), change the syringe. Any restrictions, which can easily be caused by a burred or bent needle tip, will cause excessive pressure differences that cannot be equalized with normal parameter settings. Use preferably a syringe with a solid style needle tip (side port or through port).
3. Check your method for delay times (see 4.3.5, Syringe Pullup Delay). Longer delays allow better pressure equilibrium.
4. If the sample vial is filled more than 50%, a vacuum may be created inside the vial, depending on the number of cleaning cycles with sample and injections per sample, which leads to poor filling of the syringe.
5. If you are using very low sample volumes check sample penetration depth (see 4.6.4).
6. If you are using high volatile solvents use a gastight syringe and eventually sample tray cooling.
7. Determine if the caps are being crimped properly by attempting to rotate the cap by hand. Loose caps may cause selective loss of lighter components from a sample. Adjust crimping tool correctly.

Symptom:
Results show cross contamination between samples

1. Make sure you have septa on your wash solvent and waste vials. They are an important part of the cleaning mechanism. Change them at least every 1-2 weeks.
2. Push down the plunger holder before starting a run and check if the plunger tip touches the needle (see 3.7, dead volume adjustment).
3. Make sure the dead volume of your syringe needle is not excessive. Good syringes have a needle with dead volumes less than 1 µl (typically 0.7 µl).
4. Use an appropriate wash solvent and program post injection syringe washes, at least 5 cycles. Increase the number of cycles and observe if the cross contamination problem gets reduced.

5. Check if the syringe fills completely when washing. If several cleaning cycles are programmed and many samples are processed vacuum in the solvent vial and overpressure in the waste vial may build up. Cut away a segment of the solvent and waste septa to assure equalization of pressure.

Minor Service Cases

5.2.2. Minor Service Cases

Installing the optional Parallel Board (BCD)

1. Turn the instrument off and disconnect power cord.
2. Remove the top cover (33) to get access to the control board.
3. Plug the board into the light gray bus plug on the right hand side of the processor board (47).
4. Fasten the BCD board with the stand-off screws through the two holes located on the left hand side of the BCD board.
5. Remove the black cover plate mounted on the Auxiliary plug slot and mount the male socket of the short flat cable in its place.
6. Plug the female plug into the socket on the BCD board.

Exchanging an EPROM

1. Write down all method and system parameters into table in Figure 11.
2. Turn the instrument off and disconnect the power cord.
3. Remove the top cover (33)
4. With a chip puller remove the EPROM (see Fig. 5)
5. Before inserting the replacement, make sure the two rows of legs are all straight and in line. Insert the EPROM and push all the way in. Always make sure notch of EPROM points towards the inside of the board (left).
6. Double check if all legs are in their sockets.
7. Place the cover back onto the instrument.
8. Plug in the power cord and turn on the instrument.
9. Check the control terminal for any unusual indications. If the message WARNING: SAMPLER SETUP LOST is displayed, restore all system and method parameters.

Exchanging the injection head (Fig. 1 & 3)

1. Turn the instrument off and unplug the power cord.
2. Remove the syringe.
3. Push the injection head to a place where it is not over the tray, solvent vials or injection port.
4. Disconnect the flat cable (23) that is connected to the injection head by pushing the two snap clips of the black cable socket on the injection head towards the outside.
5. Use the larger hex wrench that was provided with the instrument in the accessory bag to loosen the two screws holding the injection head to the cross-slide (18). The upper and the lower screw can be exposed by moving the syringe carrier by hand up or down so that the hole in the syringe carrier is lined up with one of the screws.
6. To mount the replacement injection head proceed in the reverse order through steps 2 - 5.

Exchanging the control terminal

1. Turn off the instrument and disconnect the power cord.
2. Disconnect the flat cable connected to the control terminal by pushing the two snap clips of the black cable socket on the control terminal towards the outside.
3. There are only two screws holding the control terminal (13, Fig. 4) to the black mounting bracket. Loosen these two screws to remove the control terminal.
4. To mount the replacement control terminal proceed in the reverse order through steps 2 - 3.

Adjusting needle guide position

1. Insert a clean syringe with the nominal needle length of 51 mm (2").
2. Loosen the set screws at the needle guide stops (7) with the 1.3 mm hex key.
3. Now the needle guide is no longer under spring load and may be moved up or down until the needle tip is about 0.5 mm inside the needle guide.
4. Fasten the set screws.
5. Double check the set position by cautiously pushing up the needle guide until the needle tip may be sensed with the finger. Check the gap below the needle guide stops to be 0.5 mm.

Adjusting vial detection

1. Turn off the instrument and disconnect the power cord.
2. Remove the injection head cover (12).
3. The switching magnet is at the upper end of one of the needle guide rods. Use the 1.5 mm hex key to adjust the magnet holder.
4. Proceed as outlined in section 4.6.2 to check adjustment.
5. Reinstall the injection head cover. Take care on the syringe drive motor cable when attaching the cover.

5.2.3. Major Service Cases

Major Service Cases

Exchanging Processor Board

1. Turn off the instrument and disconnect the power cord.
2. Remove the top cover (33).
3. Disconnect all the plug connections on the processor board.
4. Loosen the three screws along the top edge of the board.
5. Use a long stem hex wrench to loosen the four bottom screws that hold the board to the black instrument body cross member (41).
6. Carefully lift the board vertically out of the housing.
7. To install the replacement board proceed in reverse order through steps 2 - 6. Fig. 5 should be used to check the correct plug connections. Even though all plugs and sockets are keyed , and therefore prevent mix-ups of wires, it is advisable to double check these connections before turning on the instrument.

Exchanging Crossrail

1. Turn off the instrument and disconnect the power cord.
2. Remove the injection head and control terminal (see 5.2.2).
3. Remove top cover (33)
4. Remove processor board as described above.
5. There are three screws on the top edge and two on the bottom of the of the instrument body cross member within the instrument main body that need to be removed.

6. Take the cross motors cable out of the side wall including the rubber bushing.
7. Take the crossrail off including cross motor and the flat cables that connect to the injection head and terminal.
8. To mount the replacement crossrail proceed with steps 2 - 7 in reverse order.

Exchanging Bottom Plate with Vial Tray Drive

1. Turn the instrument off and disconnect the power cord.
2. Remove the top cover (33).
3. Remove the two back panel (32) holding screws. The cover can't be completely removed because of the wire connections. But pull it back off the cooling connectors (34 & 35).
4. Disconnect the tray switch and disconnect the tray motor power cable from the processor board.
5. Remove the six screws on the instrument housing side panels (40).
6. The bottom plate with the tray motor and drive can be dropped out by lifting up the upper part of the instrument.
7. To install the replacement module proceed in reverse order through steps 2 - 6.

6. Remote Control

General

6.1. General

The A200S autosampler may be controlled by a remote system connected to the serial interface. The control program is not changed to a remote control operating mode, operation is possible by using the control terminal or by the remote system via the serial connection at the same time.

The host or the user can change operating parameters. The operator needs to be careful not to mix controlling the A200S with the keyboard and the host system. However, in special circumstances the parameters can be changed directly at the control terminal, or the sampling cycle can be stopped by using the CLR key. And the utility functions can still be used. While the operator is changing a method or is using a utility function, the host parameter setting commands are not accepted. The host gets a LOCKED status to detect this situation.

The START SAMPLING signal can be generated by either the external GC READY switch or by the host system. This has to be set up in the System Parameters Program (see 4.6.1 Start Signal Source).

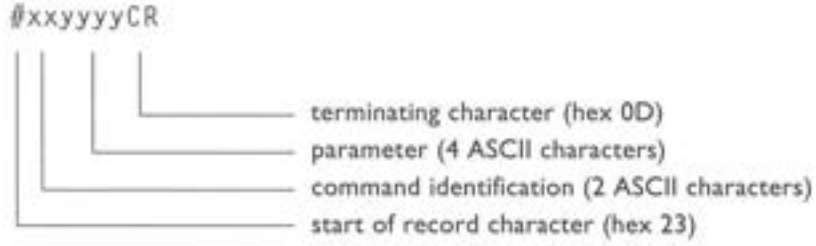
Transmission Data Format

6.2. Data Transmission Format

Both data directions, from host to sampler and from sampler to host, use the same data format. Data is coded in ASCII and is transmitted by using the following data transmission format:

1 start bit
8 data bits
1 stop bit
no parity
9600 bps

A control or status record consists of 8 characters. The first character is always # (hex 23) and the terminating character is always a carriage return character (hex 0D). The second and third characters identify the command, and the fourth to seventh characters contain a parameter value.



6.3. Command Syntax

Commands from Host to A200S

6.3.1. Commands from Host to A200S

xx	yyyy	Function
00	00zz	Request variable set by command number zz. The value yyyy is returned in the form #zzyyyyCR from the A200S to the host.
01	0000	Request status of A200S (2)
02	0000	Request status of GC (GC READY signal) (3)
07	0000	Request solvent and waste vial position
08	0000	Request number of injection points
09	0000	Request number of samples per row and column
10	0001 - 0200	Set first sample number of actual batch (1)
11	0001 - 0200	Set last sample number of actual batch (1)
12	0001 - 0099	Set sample injection count of actual batch (1)
13	0001 - 0009	Set injection method of actual batch (1). This is also the actual method for parameter setting
14	0000	Request actual sample number
15	0001 - 0009	Set actual sample processing batch number (6) Must be less or equal to last batch number
16	0001 - 0009	Set last sample processing batch number (6)
20	0001 - 0100	Set sample volume of actual method in 0.1 µl units (1). (Same as OUTERVOL for DOUBLE INJ 2 VOL) (7)
21	0000 - 0099	Set air volume of actual method in 0.1 µl units (1). (Same as OUTERVOL for DOUBLE INJ 2 VOL) (7)
22	0000 - 0099	Set solvent clean cycles after injection using solvent on terminal side (1)

xx	yyyy	Function
23	0000 - 0099	Set sample clean cycles of actual method (1)
24	0000 - 0099	Set sample pullup count of actual method (1)
25	0000 - 0200	Set minimal splitter time before injection of actual method in seconds (1)
26	0000 - 0200	Set splitter time after injection of actual method in seconds (1)
27	0000 - 0099	Set delay time from needle punch to sample injection of actual method in 0.1 second units (1)
28	0000 - 0099	Set delay time from sample injection to needle pullout of actual method in 0.1 second units (1)
29	0000 - 0099	Set pullup delay time of actual method in 0.1 second units (1)
30	0000 - 0100	Set filling volume of actual method in 0.1 µl units (1)
31	0000 - 0001	Set injection point of actual method 0 = outer ; 1 = inner (1)
32	0000 - 0099	Set standard sample volume of actual method in 0.1 µl units (1)
33	0000 - 0099	Set standard air volume of actual method in 0.1 µl units (1)
34	0000 - 0004	Injection mode of actual method (1) (7) 0 = NORMAL INJECTION 1 = INTERNAL STANDARD 2 = DOUBLE INJECTION 3 = DOUBLE INJ 2 VOL 4 = DUAL INJECTION
35	0001 - 0070	Set sample pullup speed of actual method in µl per second units (1)
36	0001 - 0070	Set injection speed of actual method in µl per second units (1)
37	0000 - 0099	Set solvent clean cycles before injection using solvent on terminal side (1)

xx	yyyy	Function
38	0000 - 0099	Set solvent clean cycles after injection using solvent on injection side (1)
39	0000 - 0099	Set solvent clean cycles before injection using solvent on injection side (1)
90	0000	Change A200S state to STANDBY
91	0000	Change A200S state to READY
92	0000	Start syringe cleaning cycle
95	0000 - 0001	Set keyboard lock; 0 = unlock; 1 = lock If locked, a corresponding message is displayed at the terminal
99	0000	Start injection of next sample in range (4)
99	mnnn	Inject sample number nnn using method m (4)

Notes:

Notes:

(1) The active method and method variables can be changed only while in STANDBY or in READY state, but not while the A200S is executing an injection cycle.

(2) The status code returned reflects the last terminated working phase. Response time to this request may be up to about 15 seconds.

(3) Requesting GC status makes sense only when the sampler is setup for remote start operation.

(4) Start command from remote system is only accepted if the A200S is set up for remote start operation. The host must check GC status either directly or via a GC status request to the sampler. The sampler ignores GC status if remote start is selected.

(5) Every command sent is answered by the A200S. Requests return the corresponding response; parameter setting commands are echoed back if accepted, injection commands are responded by a code describing the sampler action. Invalid commands or parameters are responded by the code #0000xxCR with the command number in xx.

(6) Batch definition is only possible with special control software, with standard software batch numbers are ignored.

(7) Different injection modes are only available with special control software. With standard software, NORMAL INJECTION mode is always selected.

Status Reports from A200S to Host

6.3.2. Status Reports from A200S to Host

xx	yyyy	Message
00	00zz	Command zz is not valid for this software version or has passed invalid parameter
01	ssss	Return sampler status requested by command #010000CR
02	000r	Return GC status requested by command #020000CRr=0: GC not ready; r=1: GC ready for injection
07	000p	Return solvent and waste vial position p=0: Terminal side; p=1: injection side; p=2: both sides
08	000i	Return number of injection points (i=1 or 2) requested by command #080000CR
09	rrcc	Return number of samples per row (rr) and per column (cc) requested by command #090000CR
10-39	yyyy	Return variable set with corresponding command or requested by command #0000xxCR
95	000k	Return keyboard status set by command #95000kCR k=0: unlocked; k=1: locked
97	0nnn	Injection cycle for sample number nnn was aborted by pressing CLR key
98	0nnn	Sample number nnn not in tray
99	mnnn	Sample number nnn has been injected using method m
99	0000	Sample has been injected manually (Utility function MANUAL INJECT at time zero)

Status code ssss:

Status code ssss:

0001	A200S is in STANDBY state
0w02	A200S is in READY state
0003	A200S is LOCKED by user action (Changing method, executing utility function)
1w00	Selecting sample number
2wnn	Cleaning with solvent; nn cycles passed
3wnn	Cleaning with sample; nn cycles passed
4wnn	Pulling up sample; pulled up nn times
5w00	Injecting sample
w<9 :	A200S is working
w=9 :	A200S is waiting because CLR key has been pressed

7. Parts List

Spare Parts

7.1 Spare Parts

A200S-1000	Base unit including vial tray drive, side plates and cross member. Not included are control board and transformer.
A200S-1210	Set of two cooling tubes and fittings (connection between cooling plate and cooling in- and outlets at back panel)
A200S-2000	Crossrail unit
A200S-3000	Injection head
A200S-4000	Control terminal
A200S-6100A	Transformer (43, Fig. 5) including AC power connection box (36, Fig. 4)
A200S-CTRL	Control board (Revision 3.5) (48, Fig. 5)
A200S-CHEAD	Flat cable to injection head (15, Fig. 3 & 5)
A200S-2911	Flex band for injection head cable (16, Fig. 3)
A200S-CTERM	Flat cable to control terminal (14, Fig. 3 & 5)
SNS1-205	Switch 205mm for tray home position (42, Fig. 5), syringe up and vial detection
SNS1-310	Switch 310mm for plunger down detection
SNS1-530	Switch 530mm for cross home and inject position
A200S-ZUB	Accessories Kit for Autosampler A200S (consists of 1 long hex key 2.5mm, 1 hex key 1.5mm, 1 hex key 1.3mm, 2 wash vials, 2 caps for wash vials, 2 seals for wash vials, 2 adaptors for cooling connectors)

7.2 Options

A200S-BCDOUT	Interface board for BCD sample number output. Includes installation hardware and cable to back panel
A200S-SW-EXP	Special control software with expert programming options
A200S-1303	Solvent/waste vial holder for second cleaning position (2 x 5 ml vials)
A200S-1304	Solvent/waste vial holder for two cleaning positions on home side (4 x 10 ml vials, e.g. Chromacol 10-CV)
A200S-2400	Injection head displacement kit (Extends crossrail projection by 75 mm)
A200S-5100	Sample tray 200 x 0.7 ml (e.g. Chromacol 07-CPV(A))
A200S-5200	Sample tray 32 x 5 ml
A200S-5300	Sample tray 105 x 2 ml (e.g. Chromacol 2-CV)
VENT 2/2 24VAC	Splitter valve 2-way 24 Volt AC without connection cable
VENT 3/2 24VAC	Splitter valve 3/2-way 24 Volt AC without connection cable
Kab Ventil	Connection cable for splitter valve

7.3 Consumables

SYR A200S	Standard syringe 10 µl
KIT 100x0.7ml	Kit of 100 pcs each vials, caps, seals 0.7 ml
KIT 100x2ml	Kit of 100 pcs each vials, caps, seals 2 ml
KIT 100x5ml	Kit of 100 pcs each vials, caps, seals 5 ml
KIT WASH	Kit of 10 pcs each vials, caps and 20 pcs seals for wash position (5 ml)
Starter Kit 0.7ml	Starter Kit for 0.7 ml vials (i.e. 200 sample tray) (Syringe 10 µl, crimping tool 8 mm, 1000 pcs each vials, caps, seals 0.7 ml)
Starter Kit 2ml	Starter Kit for 2 ml vials (i.e. 105 sample tray) (Syringe 10 µl, crimping tool 12 mm, 1000 pcs each vials, caps, seals 2 ml)
Starter Kit 5ml	Starter Kit for 5 ml vials (i.e. 32 sample tray) (Syringe 10 µl, crimping tool 20 mm, 500 pcs each vials, caps, seals 5 ml)

Figure 1
Front View

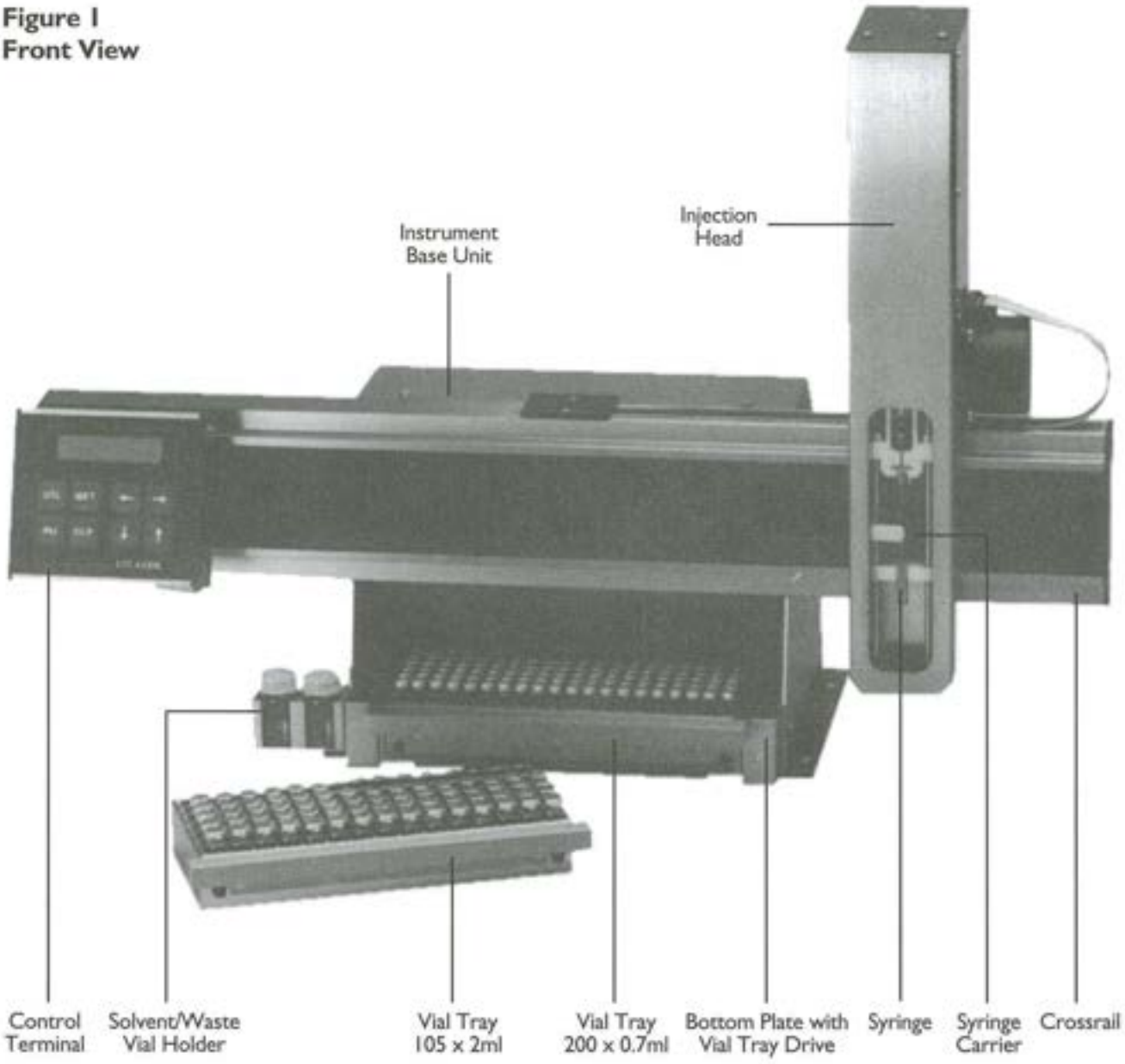
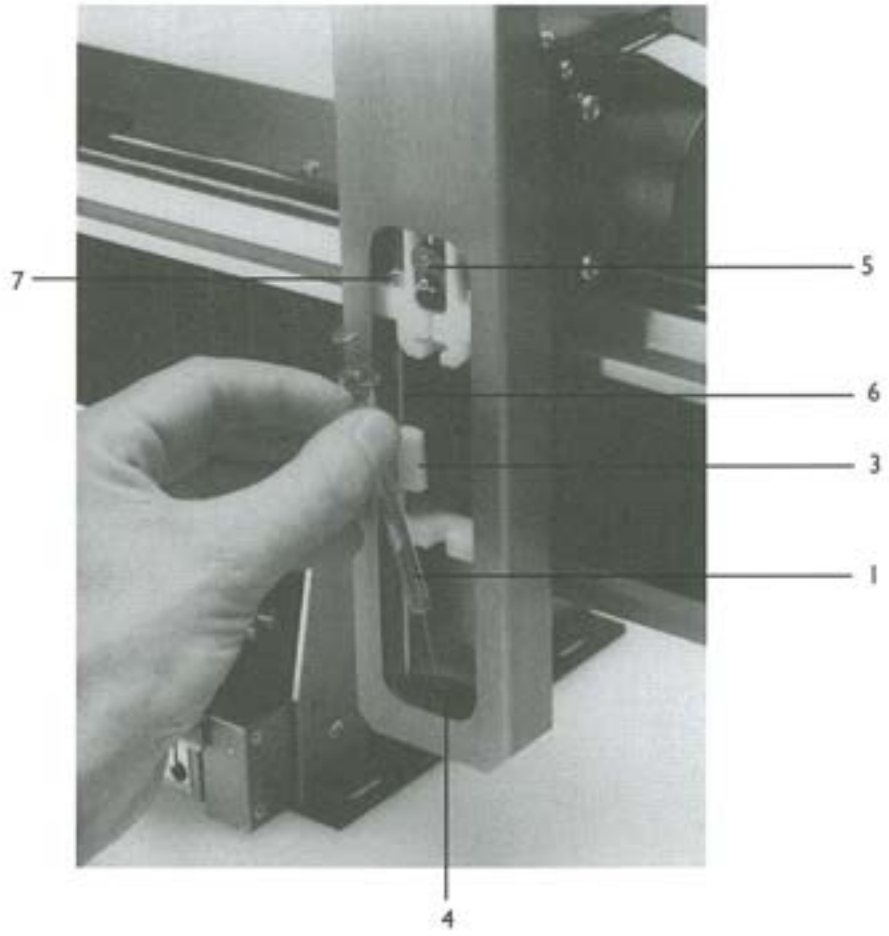
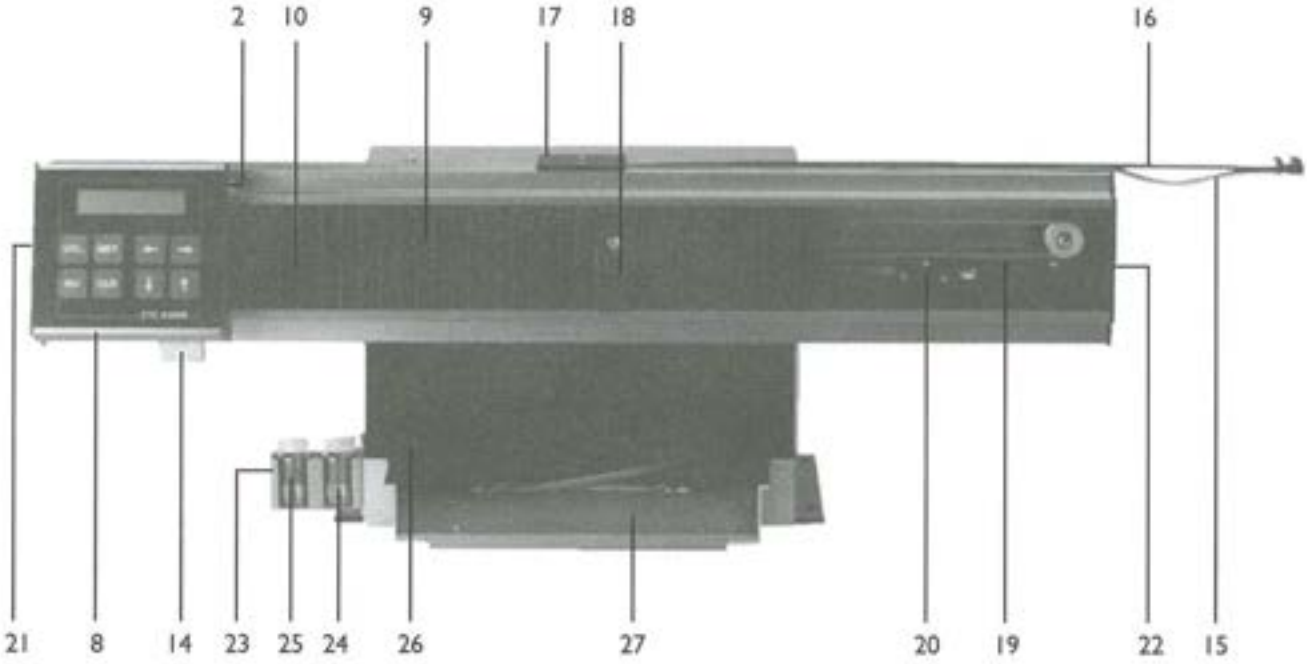


Figure 2
Syringe Carrier



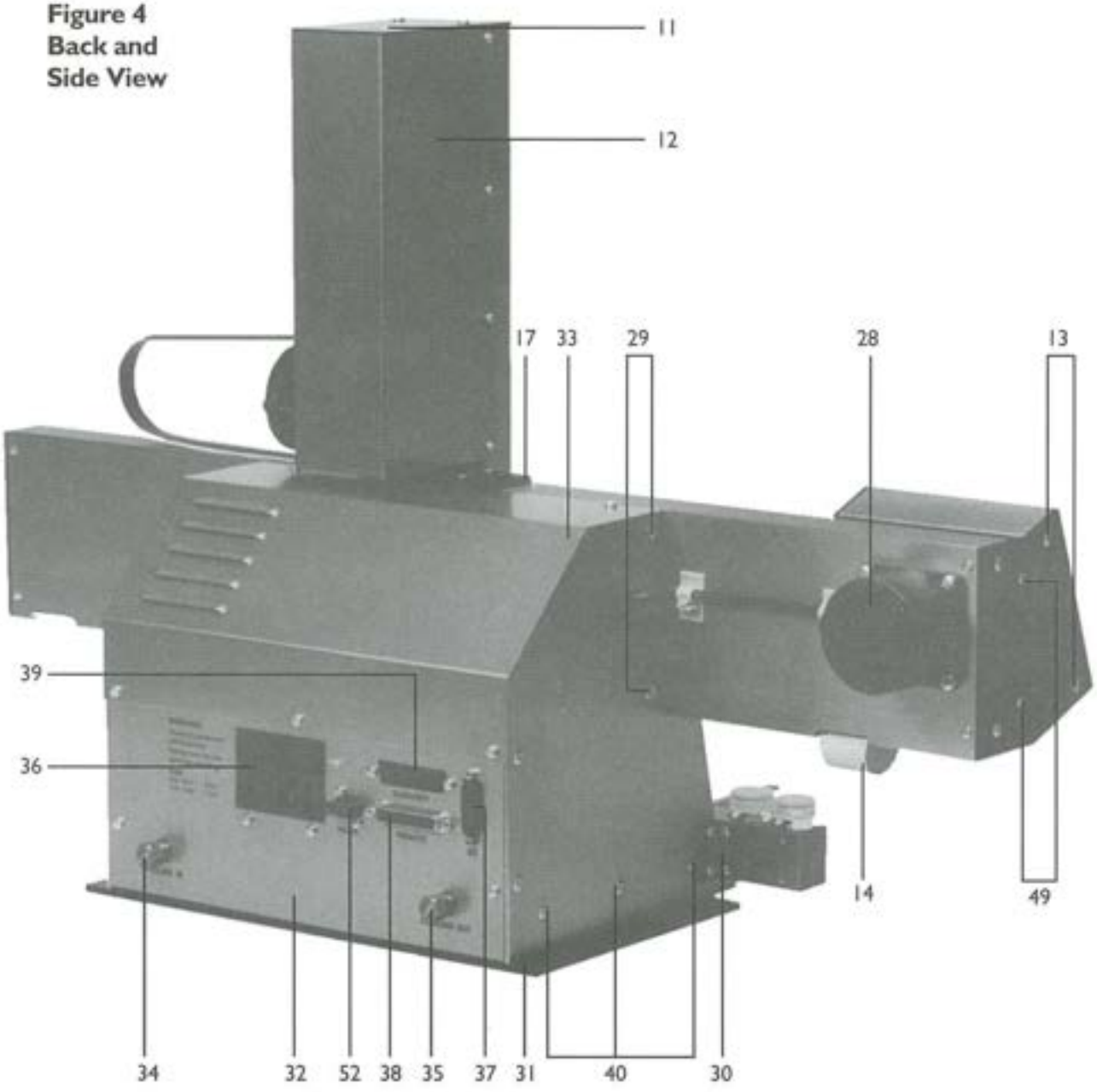
1. Syringe
3. Syringe Fixing Lever
4. Needle Guide
5. Plunger Holder
6. Needle Guide Rods
7. Needle Guide Stops

Figure 3
Front View Crossrail



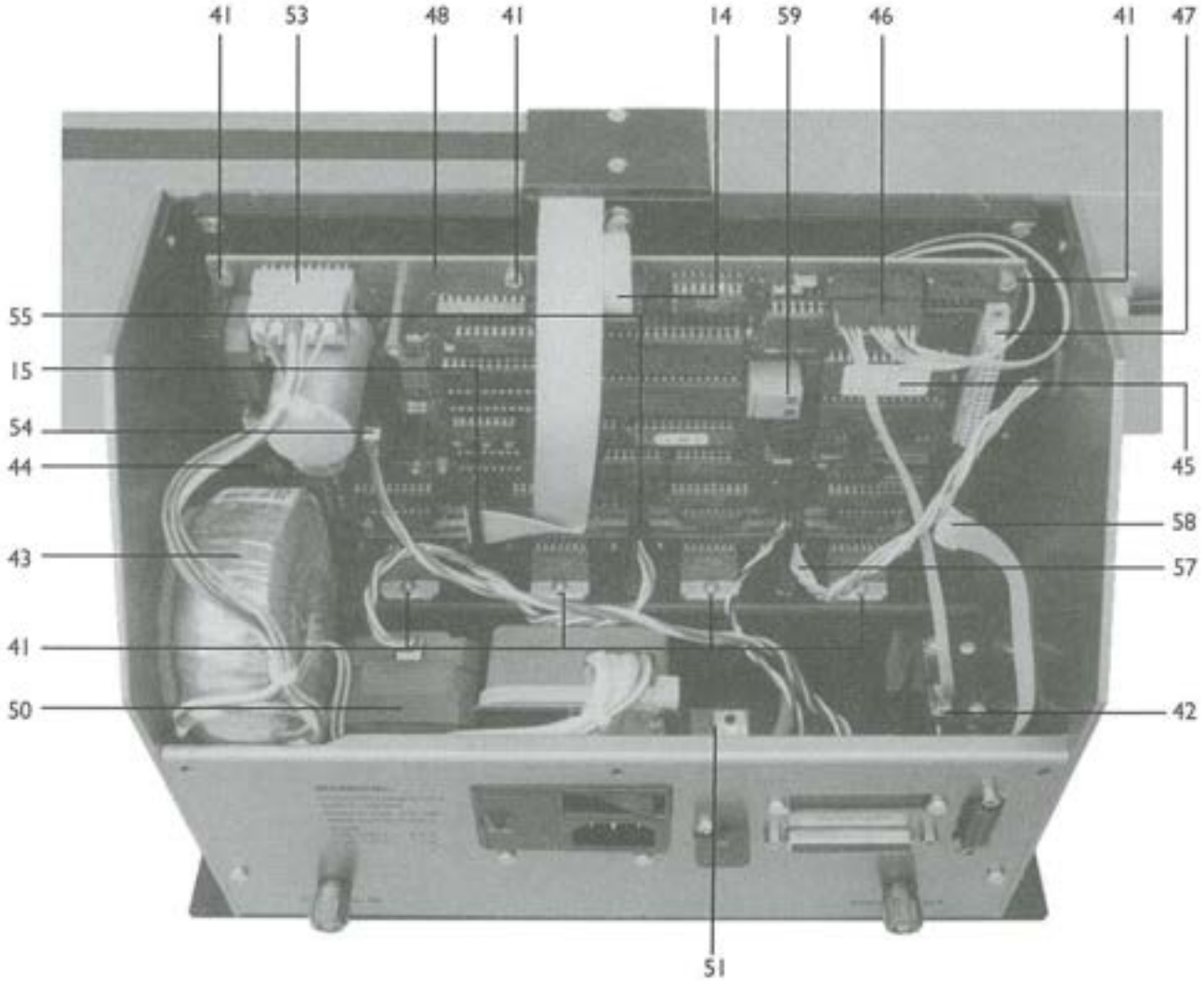
2. Control Terminal End Cover
8. Control Terminal
9. Crossrail Dust Cover
10. Home Position Switch
14. Flat Cable (Control Terminal)
15. Flat Cable (injection head)
16. Metal Flex Band
17. Flat Cable Bracket
18. Cross Slide
19. Toothed Belt
20. Injection Point Switch
21. End Cover (Terminal Side)
22. End Cover (Injection Side)
23. Solvent/Waste Vial Holder
24. Wash Solvent Vial
25. Waste Vial
26. Tray Switch Activator
27. Cooling Plate

Figure 4
Back and
Side View



11. Injection Head Top Cover
12. Injection Head Cover
13. Control Terminal Mounting Screws
14. Flat Cable (Control Terminal)
17. Flat Cable Bracket
49. Dust Cover Screws
28. Cross Motor
29. Cross Rail Mounting Screws
30. Wash Solvent/Waste Bottle Bracket
31. Bottom Plate
32. Back Panel with Instrument Connectors
33. Top Cover
34. Cooling Inlet
35. Cooling Outlet
36. AC Power Connection Box
37. GC Interface Connector (female)
38. RS 232 Connector (female)
39. Optional Parallel Connector
40. Tray Drive Holding Screws
52. Splitter Valve Connector

Figure 5
Instrument Main Body with Electronics



14. Flat Cable to Control Terminal
15. Flat Cable to Injection Head
41. Mounting Screws for Processor Board (7 pieces)
42. Tray Home Position Switch
43. Transformer
44. Replaceable Board Fuse
45. EPROM
46. Position Switch Cables
47. Bus Connector (Parallel Interface Board)
48. Processor Board
50. Tray Drive Motor
51. Splitter Valve Control Board
53. Transformer Connector
54. Serial Interface Connector
55. Tray Motor Connector
56. Splitter Control Connector
57. Cross Motor Connector
58. GC Interface Connector

Figure 6
Control Terminal

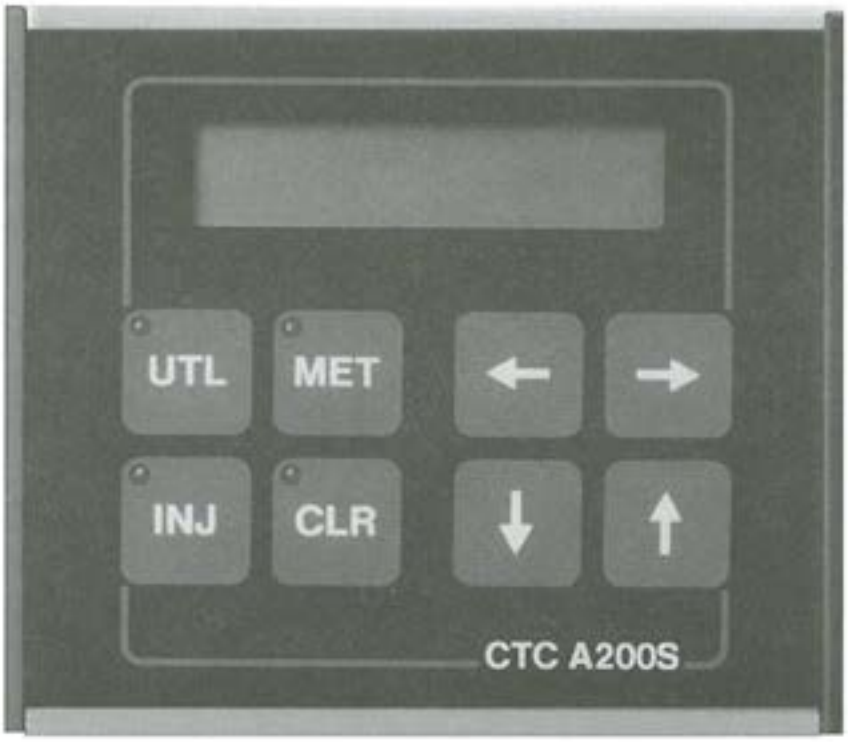


Figure 7
Software Diagram

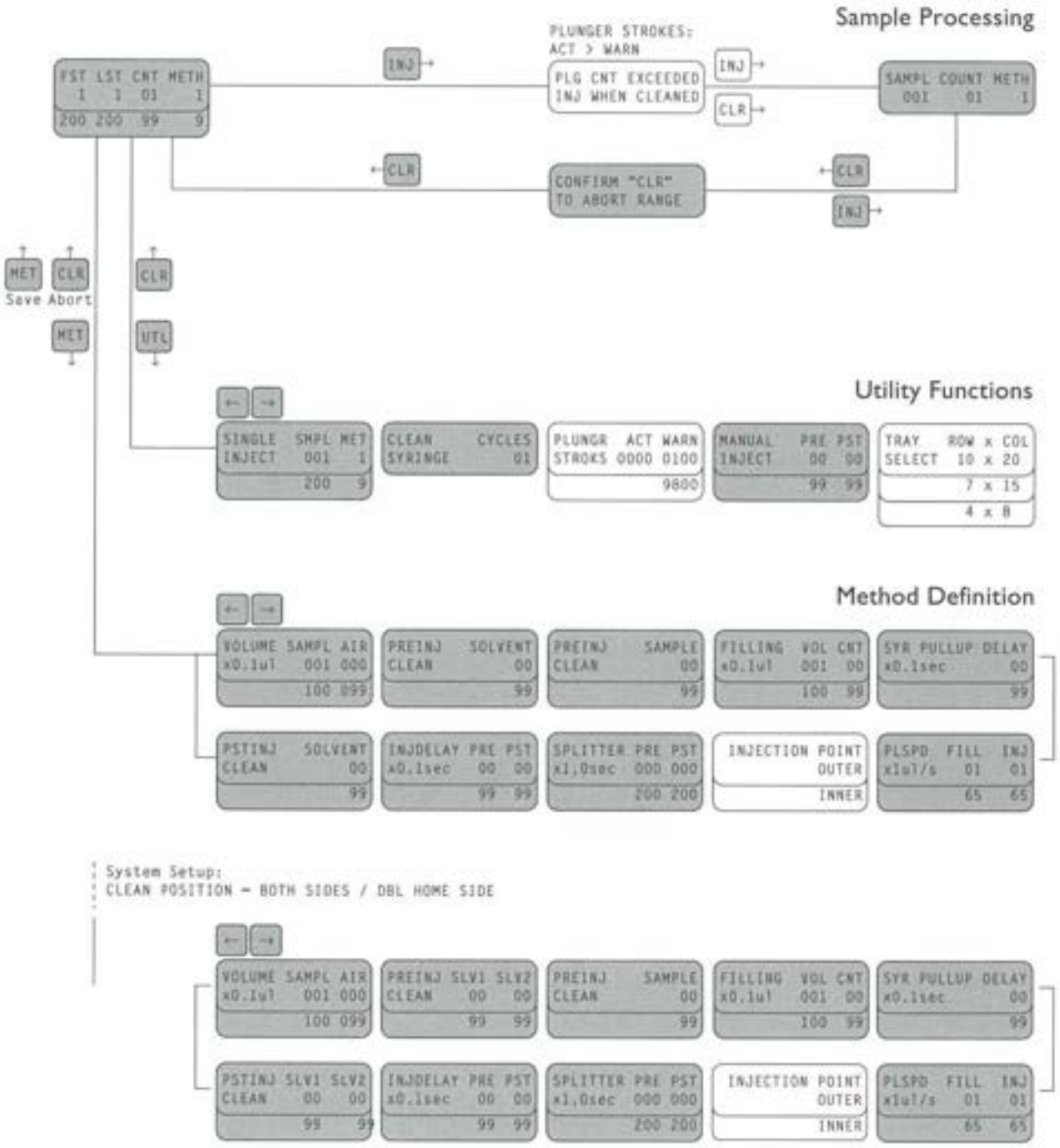


Figure 8
System Setup Diagram

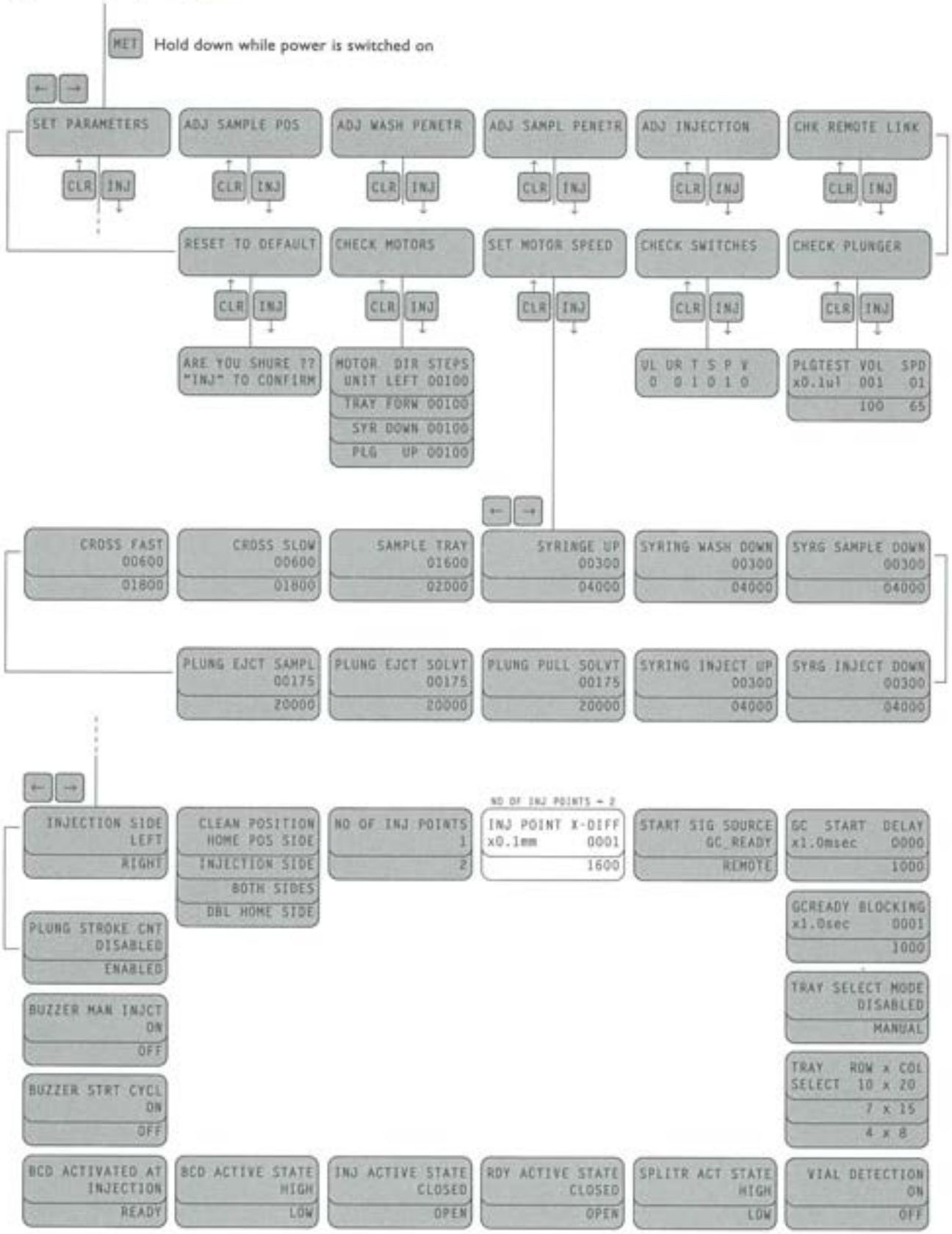


Figure 9
Wiring and Identification of Electronic Components

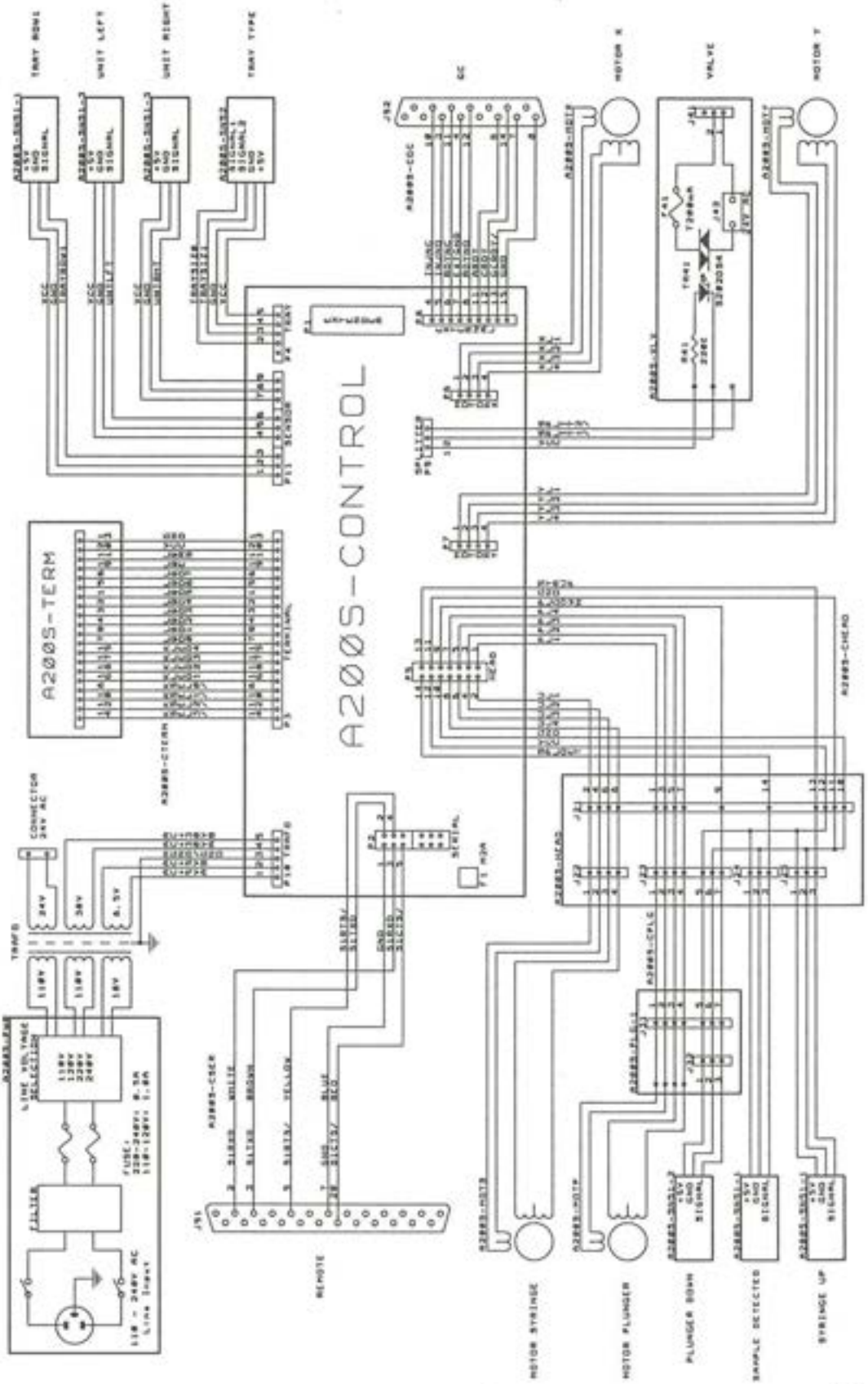


Figure 10
External Input/Output Circuit

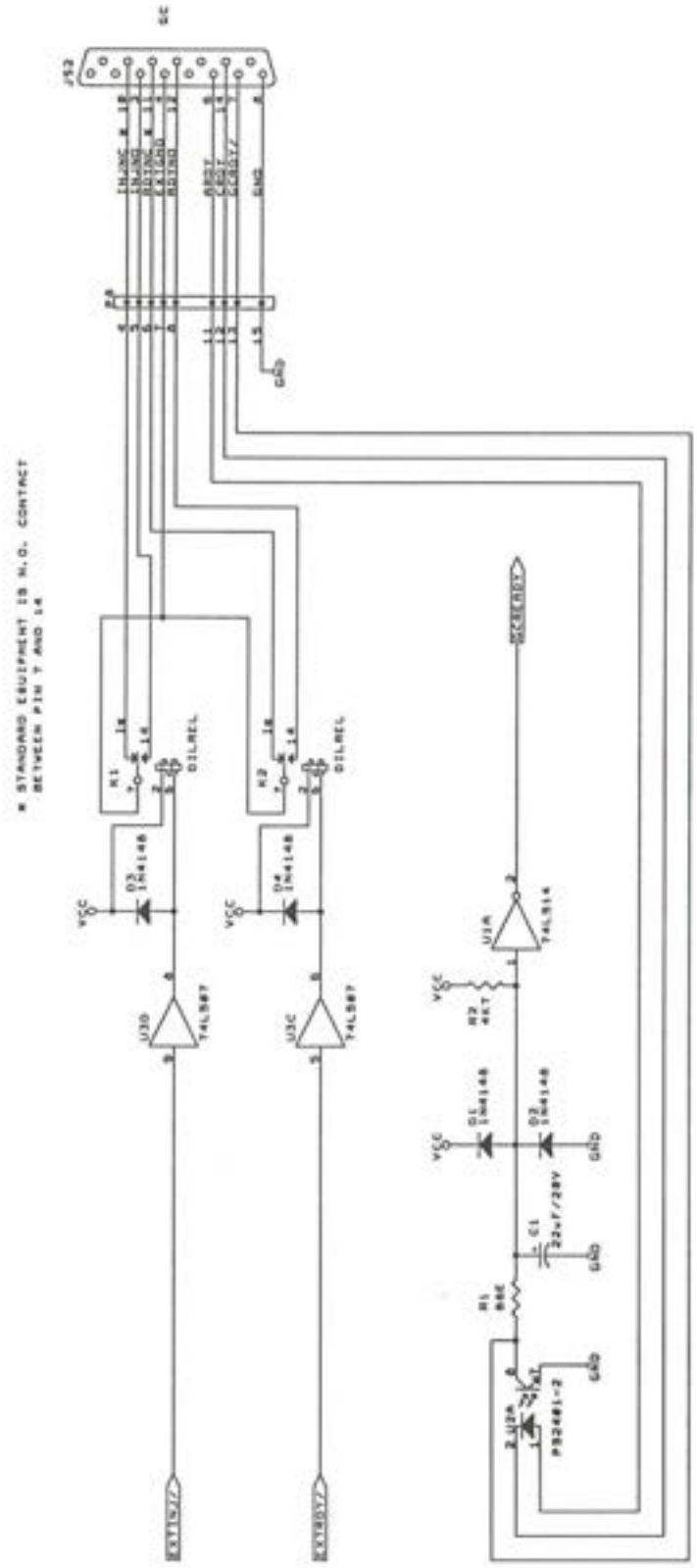


Figure 11 Table with Setup Values

System Parameters		Default	Actual
Injection side	INJECTION SIDE	LEFT	
Clean position	CLEAN POSITION	HOME POS SIDE	
Number of injection points	NO OF INJ POINTS	1	
2nd injection point x-difference	INJ POINT X-DIFF	0	
Start signal source	START SIG SOURCE	GC_READY	
GC start delay	GC START DELAY	20	
GC Ready blocking	GCREADY BLOCKING	0	
Tray select mode	TRAY SELECT MODE	DISABLED	
Tray selected	TRAY SELECT	10 x 20	
Vial detection	VIAL DETECTION	ON	
Splitter valve active state	SPLITR ACT STATE	HIGH	
Sampler ready relay active statet	RDY ACTIVE STATE	CLOSED	
Injected relay active state	INJ ACTIVE STATE	CLOSED	
BCD output active state	BCD ACTIVE STATE	HIGH	
BCD activation time	BCD ACTIVATED AT	INJECTION	
Buzzer activation at cycle start	BUZZER STRT CYCL	ON	
Buzzer activation at manual injection	BUZZER MAN INJCT	ON	
Plunger stroke count warning	PLUNG STROKE CNT	ENABLED	

Motor Speeds			
Syringe up at wash and sample pos.	SYRINGE UP	01200	
Syringe down at wash position	SYRING WASH DOWN	01200	
Syringe down at sample position	SYRG SAMPLE DOWN	01200	
Syringe down at inject position	SYRG INJECT DOWN	01200	
Syringe up at inject position	SYRING INJECT UP	01200	
Plunger pullup solvent	PLUNG PULL SOLVT	02000	
Plunger eject solvent	PLUNG EJCT SOLVT	00400	
Plunger eject sample	PLUNG EJCT SAMPL	00400	
Crossway fast	CROSS FAST	01000	
Crossway slow	CROSS SLOW	01150	
Sample tray back and forward	SAMPLE TRAY	01600	

Method Parameters		Default	Meth 1	Meth 2	Meth 3	Meth 4	Meth 5	Meth 6	Meth 7	Meth 8
VOLUME	SAMPL AIR	10 10								
PREINJ CLEAN	SLV1 SLV2	0 0								
PREINJ CLEAN	SAMPLE	0								
FILLING	VOL CNT	50 10								
SYR PULLUP	DELAY	05								
PLSPD	FILL INJ	08 25								
INJ POINT	OUTER									
SPLITTER	PRE PST	000000								
INJDELAY	PRE PST	10 10								
PSTINJ CLEAN	SLV1 SLV2	05 00