Addendum for PAL User Manual
PAL Dilutor Option
Installation and Operation

Printing History

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Edition 2	October 2008
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Original Instructions

A. Safety Information

Declaration of Conformity

See Declaration of Conformity sheet enclosed with the instrument

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General Considerations

Any changes or modifications to this unit not expressly approved by the party responsible for compliance could nullify the user's authority to operate the equipment. The user should be aware that if the equipment is used in a manner not specified by the manufacturer, the protective and safety features of the equipment may be impaired.

⚡

Electrical Hazard

Every analytical instrument has specific hazards, so be sure to read and comply with the precautions as described in the corresponding PAL User Manual.

Use only fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.

Other Hazards

To avoid injury during PAL System operation, keep hands away from the syringe.

For detailed Safety Information, see the addinional warnings in the corresponding PAL or PAL-xt User Manual or in the booklet 'Safety Information and Warnings for Users of the PAL System'..

Commonly Used Symbols

Symbol	Description
⚠	Caution, or refer to User Manual
(needle-stick symbol)	Caution, Risk of Needle-Stick Puncture
(hot surface symbol)	Caution, Hot Surface or High Temperature
(crushing symbol)	Danger of crushing to fingers and hands
(laser symbol)	Laser Warning, Barcode Reader
(biohazard symbol)	Biological Hazard
(direct current symbol)	Direct Current
∼	Alternating Current
(ground symbol)	Protective Conductor Terminal, Ground
(fuse symbol)	Fuse
(vertical bar symbol)	Electrical Power ON Used with Main PAL Power Supply
○	Electrical Power OFF Used with Main PAL Power Supply
(lightning symbol)	Caution, Risk of Electrical shock (high voltage)
(WEEE bin symbol)	Disposal: Do not dispose in municipal waste. Follow local waste regulations to reduce electrical and electronic waste (WEEE).

Table 1. Commonly Used Safety Symbols

B. Table of Contents

C. List of Figures and Tables

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D. How to Use this Manual

note — *This Addendum covers the PAL Dilutor Option which can be used in combination with PAL Systems (e.g. HTS PAL or COMBI PAL) and PAL-xt Systems (PAL HTS-xt or PAL COMBI-xt). Issues specific to the PAL-xt System have been emphasized accordingly.*

note — *The PAL System must be installed and set up properly before the PAL Dilutor Option Operating Instructions can be implemented.*

The major sections of this Addendum are:

- Safety Information
- PAL Dilutor Option Installation
- PAL Dilutor Option Operating Instructions
- Appendices

The 'PAL Dilutor Option Installation and Operation Addendum' is intended for frequent PAL users or new users who are experienced in using automated systems to perform existing analytical methods.

The Appendices provide information about the PAL Dilutor Options and Spare Parts.

E. PAL Dilutor Option Installation

1. General System Overview

Figure 1. PAL Dilutor General System Overview

The PAL Dilutor is an optional device for the PAL System. The main purpose is typically solvent handling, such as adding a solvent for dilution, a reagent for derivatization, spiking with an internal standard etc. Another widely used application is sampling an exact volume of an aliquot and pipetting it into another vessel for further processing.

The advantage of the PAL Dilutor option is in handling certain solvents (diluting application) and, at the same time, using the Dilutor syringe for injection into a chromatographic system, either a GC or HPLC system.

Besides the typical solvent handling application, the PAL Dilutor option is used as a wash station device for the HPLC technique. If the cycle time of the HPLC technique is critical, this approach provides a valid alternative.

1.1. Specifications

Article number:	PAL Dilutor
Dilutor syringe:	2.5 mL (optional 1mL, 5 mL, and 10 mL)
• Volume range:	0.25 µL/s – 2.5 µL/s
• Flow rate range:	10 µL/s– 300 µL/s
Side port syringe:	80 µL with removable needle (optional 4, 20, 800 µL)
• Flow rate range:	1 µL/s– 200 µL/s
Transfer tubing kit:	2 pcs. PTFE tubes ID 0.787 mm (1/32″) / OD 1.58 mm (1/16″), 620 µL including connection fittings and guiding wire
Solvent reservoir:	1000 mL borosilicate glass including Glass Filter, 40 µm pore size
Control:	Cycle Composer Software Version 1.4 or higher
PAL Firmware:	Version 2.3.X or higher
Piston/Valve Drive:	Stepper motor with independently operated solenoid valve
Wetted parts:	All liquids compatible with borosilicate glass, PTFE, Kel-F, FEP
Dimensions: (Dilutor module)	Width: 47 mm Depth: 67 mm Length: 217 mm Weight: 980 g

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1.2. Hardware Requirements

The PAL Dilutor option can be used with any PAL System (e.g. HTS PAL or COMBI PAL) or PAL-*xt* system (e.g. PAL HTS-*xt* or PAL COMBI-*xt*) equipped with a side slot injection unit. One auxiliary port ('AUX') to control must be available for each Dilutor installed.

1.3. Software Requirements

The PAL Dilutor option can be operated with PAL Firmware version 2.3.X
or higher and for a PAL-*xt* System, PAL Firmware version 4.1.X or higher is
required.
It can be controlled using PAL Control software, the Cycle Composer or any
CDS (chromatography data system) software that controls the PAL System
including those using the Cycle Editor for PAL ICC interpretation (e.g. Analyst,
ChemStation, Empower, EZChrom, MassLynx, Xcalibur).

For details, see Section F point 3 'PAL Firmware and Firmware Object
Installation for PAL Dilutor Option'.

2. Installation

2.1. Unpacking the Components

The PAL Dilutor Option is shipped in one box. Check for the following items:

1. Dilutor Module
2. PTFE Dilutor Syringe Washer (2pcs.)
3. Dilutor Syringe
4. Dilutor Syringe Screw
5. Sideport Syringe Plunger
6. Plunger Sealing Screw
7. Perfluor O-Ring
8. Sideport Syringe with removable Needle
9. Sideport Syringe Plunger Holder
10. Sideport Syringe Adapter
11. Solvent Bottle transfer line including Glass Filter 40µm pore size
12. Solvent Bottle with cap
13. Transfer Tubing Kit
14. Dilutor Module connection cable
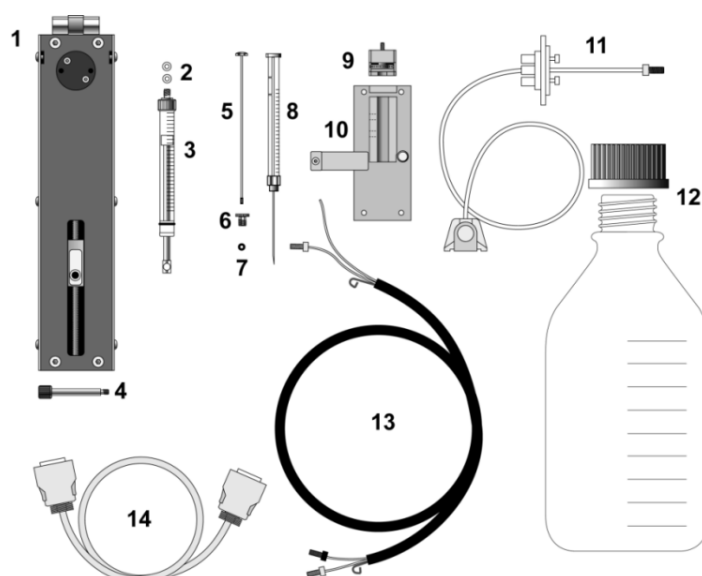
Figure. 2. PAL Dilutor Parts

2.2. Assembling the PAL Dilutor

Before beginning the assembling process, determine approximately where the PAL Dilutor should be placed on the left end of the PAL X- axis. This is because the tubing is connected on the left side of the syringe holder bracket leading to the Dilutor module.

note

The standard 3-way Dilutor solenoid valve is made out of PCTFE also known as KEL-F®. Wetted parts: PCTFE/PTFE. Not compatible with solvents such as Toluene, THF or DMSO.
An optional valve made out of PTFE is available.
For details, see the Appendices for 'Spare Parts'.

1. Before attaching the Dilutor module unit to the PAL X-axis, turn it upside down and insert one PTFE washer into the lower Dilutor solenoid valve port;

2. Carefully screw the Dilutor syringe into the lower solenoid valve port and tighten it firmly;

3. Insert the Dilutor syringe screw into the syringe barrel hole, and screw it into the Dilutor plunger holder (Fig. 3);
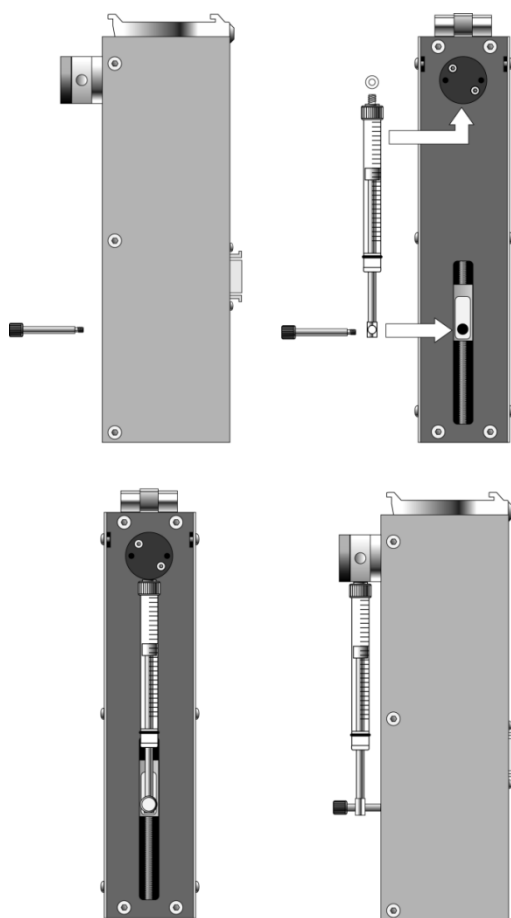
Figure 3. Inserting the Dilutor Syringe

4. Install the PAL Dilutor module with the mounting clamp teeth fitting into the grooves on the bottom of the X-axis. The Dilutor must be mounted at the left end of the PAL X-axis. Be sure that the clamp fits completely into the grooves. Tighten the Torx screw until the mounting clamp is firmly in place (Fig. 4);
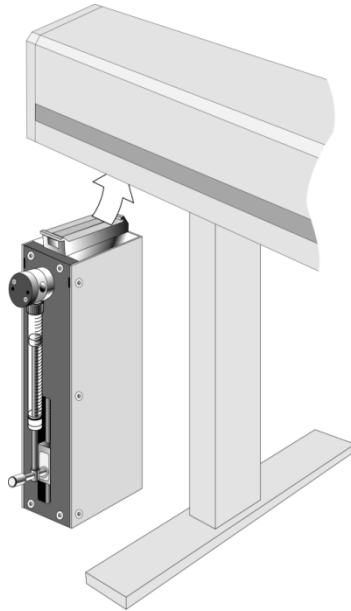
Figure 4. Attaching the Dilutor to the PAL X-Axis

5. Double check if the PAL Dilutor mounting clamp is correctly attached to the PAL X-axis (see Fig. 5).
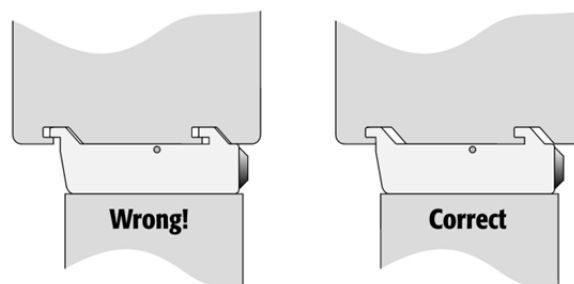
Figure 5. Dilutor Mounting Clamp Attachment

2.2.1. Installing the Transfer Tubing

1. Unscrew the left top Dilutor cover Torx screw;

2. Use the end of the tubing kit that has one connection nut. Start by connecting the guide wire end at the side with one nut only;

3. Insert the transfer tubing guide wire into the left cover slit;

4. Adjust the guiding wire to a 90° angle to the Dilutor cover and tighten the Torx screw again firmly;

5. Connect the white connection fitting to the left hand port of the Dilutor solenoid valve (Fig. 6);
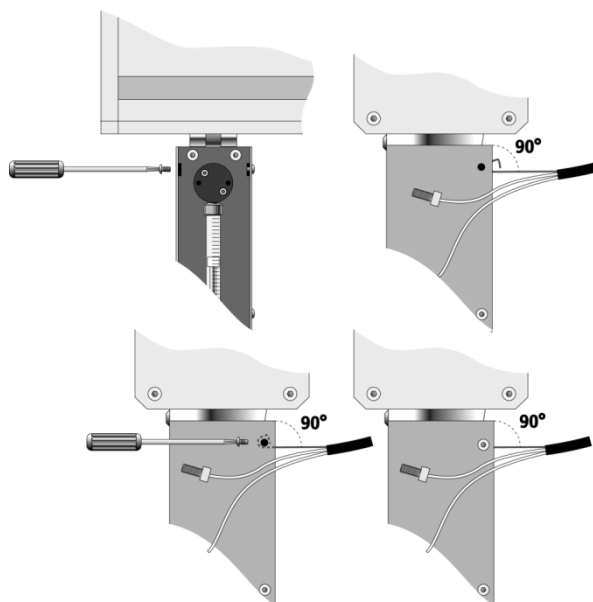
Figure 6. Attaching the Transfer Tubing Kit to the Dilutor Module

6. Open the Torx screw at the guide bracket of the sideport syringe adapter;

7. Use the end of the tubing kit that has two connection nuts.
    Start by connecting the guide wire end at the side with two nuts;

8. Insert the transfer tubing guide wire into the guide bracket slit;

9. Adjust the guide wire to a 90° angle to the bracket and tighten the Torx screw firmly (Fig. 7).
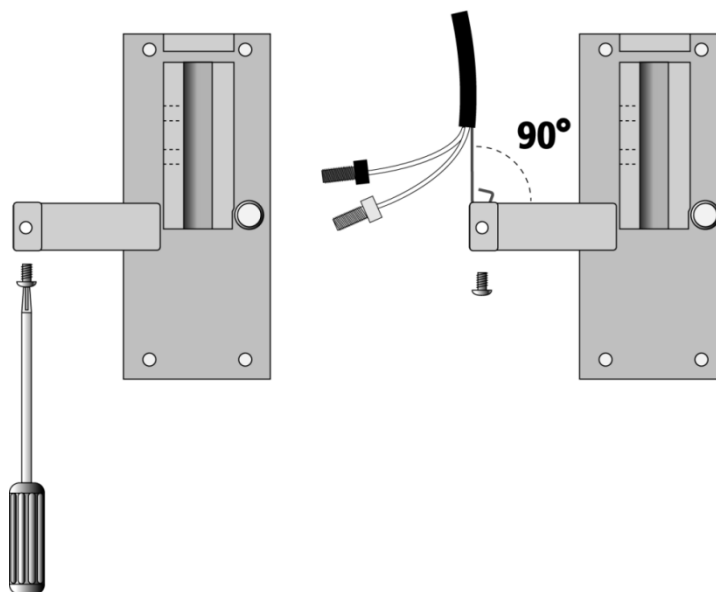
Figure 7. Attaching the Transfer Tubing to the Sideport Syringe Adapter

2.2.2. Installing the Sideport Syringe

1. Insert the sideport syringe without plunger into the syringe adapter. Make sure the syringe side holes are adjusted to the left side;

2. Locate the black connection fitting and screw it into the upper connection thread;

note — *The syringe barrel has to be loose until the tubing's are connected to the side ports. This allows a tight seal from the tube to the glass.*

3. Locate the white connection fitting and screw it into the lower connection thread;

4. Place the plunger sealing screw over the syringe plunger;

5. Place carefully the black Perfluor O-ring over the syringe plunger;

6. Insert the plunger into the sideport syringe and carefully screw the plunger sealing screw into the syringe adapter bracket.
See Figure 8.

note — *Do not over tighten the plunger sealing screw. Check plunger friction by manually moving the plunger up and down. Loosen the plunger sealing screw if too much friction arises.*
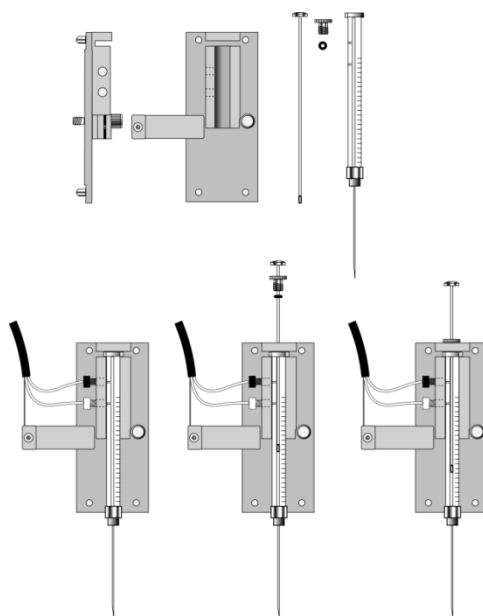
Figure 8. Installing the Sideport Syringe

2.2.3. Installing the Sideport Syringe Adapter

note ———————— *It is advisable to install the syringe holder in the PAL system with power turned off.*

1. Make sure the tubing kit connection fittings and their guide wire are attached properly to the sideport syringe adapter. The syringe plunger must also be inserted in the sideport syringe. The plunger holder is already attached to the plunger bushing , as shown in Figure 9;
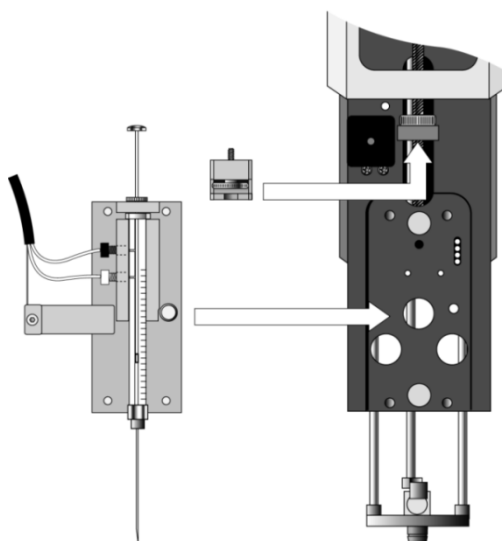
Figure 9. Installing the Sideport Syringe Plunger Holder

2. Move the PAL Injection Unit manually to the side to allow free movement of the syringe slider, as shown in Figures 9 and 10;

3. Lower the syringe slider in order to gain access to install the syringe assembly;
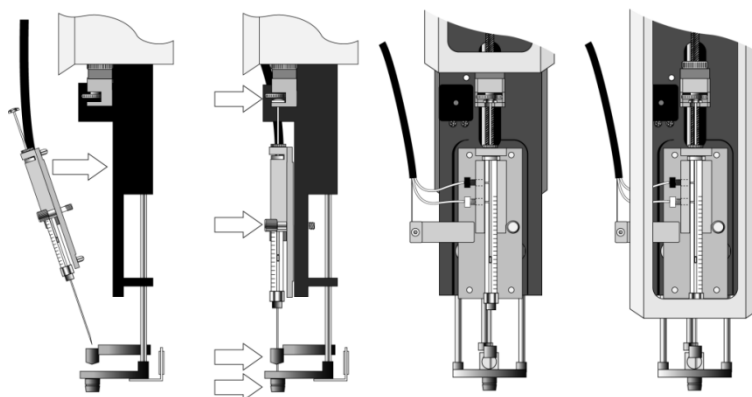
Figure 10. Installing the Sideport Syringe Adapter

4. Lift the lower needle guide, sliding it into the upper needle guide. Insert the syringe needle tip and match the magnetic pins of the syringe holder with their counter positions on the syringe slider;

5. Let the lower needle guide return slowly and make sure the needle tip does not catch on the guide.
Press the syringe holder firmly against the Z-axis slider to ensure that the syringe holder engages. Tighten the screw from the holder to the syringe slider;

6. Guide the syringe adapter side bracket through the left hand Injection unit slit;

7. Move the plunger up and place the plunger button into the plunger holder.

8. Turn ON the PAL power supply. During the syringe initialization process, the plunger moves down until it hits the mechanical stop.
This position is stored as the syringe's zero volume position.

note

After replacing a sideport syringe in a PAL System, always check the needle penetration in the LC valve (see the corresponding PAL User Manual, Chapter 9, Injection Valve Needle Penetration).

2.2.4. Removing the Sideport Syringe Adapter

Repeat steps 1 – 8 in Topic 2.2.3 in reverse order.

2.2.4. Connecting the Solvent Bottle Tubing

1. Attach the Glass solvent filter to the solvent transfer line and insert the filter into the solvent bottle;
2. Connect the other end of the solvent line to the right hand port of the Dilutor solenoid valve;
3. Fill the solvent bottle with solvent;
4. Close the solvent bottle with the supplied blue cap;
5. Position the solvent filter close to the bottom of the solvent bottle.
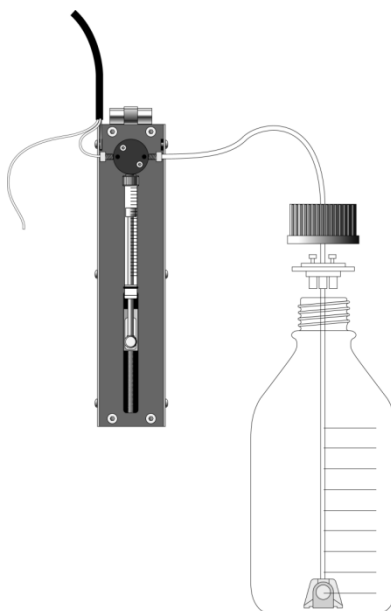
Figure 11. Connecting the Solvent Bottle Tubing

2.2.6. Electrical Connection

note

Always switch OFF the PAL power supply before connecting or disconnecting the PAL Dilutor option or any other PAL accessory cable!

Before operating the PAL Dilutor, make sure it is correctly connected to the 'AUX2' connector at the PAL X-axis rear side (see Fig. 12).
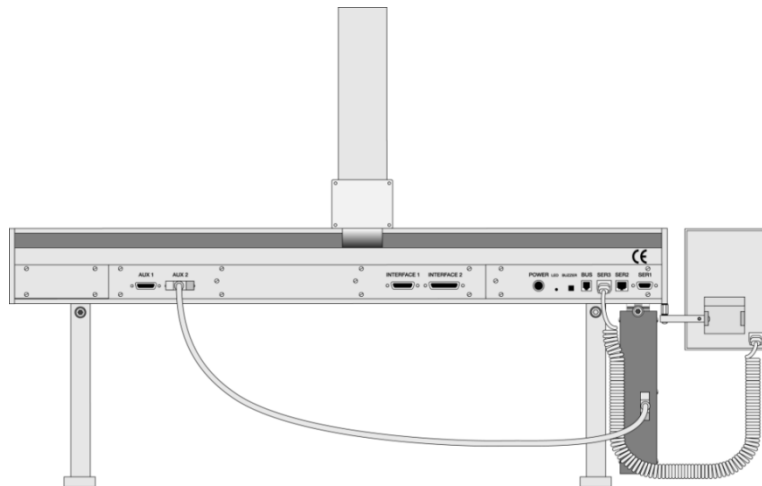
Figure 12. Electrical Connection

note

The electrical connection for the PAL-xt system is identical. Use the 'AUX2' connector as well. Usually either a Valve Drive or an Agitator is connected by default to the 'AUX1' interface.

3. PAL Firmware and Firmware Object Installation for PAL Dilutor Option

3.1. PAL System Firmware Installation for PAL Dilutor Option

The PAL Dilutor Option in combination with a PAL System requires PAL Firmware version 2.3.X or higher. In case a lower firmware version is installed on the unit in use, it is recommended to upgrade the firmware to the current version.

With PAL Firmware version 2.5.X, the ability to operate two PAL Dilutors installed on the same unit was added. A possible application is the use of the Dilutor as a Wash Station. Dilutor #1 supplies an aqueous solvent and Dilutor #2 an organic solvent. The Dilutor transfer tube from the first unit is attached to the Sideport syringe, upper position, and the tube from the second unit would be attached to the lower port.
For an application using biofluid samples, proteins or peptides should be washed in the appropriate order, first with aqueous solvent, followed by organic solvent to avoid precipitation.

The PAL Dilutor Option, in single or dual use, can be controlled using PAL control software, the Cycle Composer or any CDS (chromatography data system) software that controls the PAL System including those using the Cycle Editor for PAL ICC interpretation (e.g. Analyst, ChemStation, Empower, EZChrom, MassLynx, Xcalibur).

(See the section 'Installation', point 1.2 'Hardware Requirements', and point 1.3 'Software Requirements'.)

3.2. PAL-*xt* Firmware Installation for PAL Dilutor Option

If the PAL Dilutor Option is used in combination with a PAL-*xt* System, PAL Firmware version 4.1.X or higher is required. The PAL-*xt* System also requires the PCB 'APR Control-*xt*' and the PAL-*xt* Object lists Revision B or higher (see below).

3.3. PAL Firmware Object List Installation for PAL Dilutor Option

A CD-ROM is provided together with the PAL Dilutor Option, which contains the required PAL Firmware Objects to enable the use of the technique. Required PAL Object Manager Object Lists:

- PAL System: PAL Object List Revision K or higher
- PAL-*xt* system: PAL-*xt* Object List Revision C or higher

PAL Systems:

If the revision level of the PAL Object Manager List installed on the computer is lower than 'K', copy the provided folder 'Dilutor Option' from the CD-ROM to the Object Lists folder which has been installed with the Object Manager. This software is usually installed in the following path:

C:\Program Files\PAL\Object Manager\Object Lists

Using a firmware Object List revision 'K' or higher, this 'Dilutor Option' folder will become a part of the list.

PAL-*xt* Systems:

If the PAL Dilutor Option is configured to a PAL-*xt* System, use the provided PAL-*xt* Object List Rev. C or higher.
DO NOT use an Object List from the PAL System (example Rev. K), because the structure of the Object has changed and is not compatible with the PAL-*xt* Firmware.
Copy the PAL-*xt* Object List from the CD-ROM to the PAL Object Manager software which is usually installed in the following directory path:

C:\Program Files\PAL\Object Manager\Object Lists

If the PAL Object Manager software is not installed yet, use the provided 'PAL System CD' or 'PAL-*xt* System CD'. Instructions are provided with the CD.

The following Object Lists are available:

Dilutor_Aux1   Dilutor ID#1 connected to 'AUX1' interface
Dilutor Aux2   Dilutor ID#1 connected to 'AUX2' interface
Dilutor2_Aux1   Dilutor ID#2 connected to 'AUX1' interface
Dilutor2_Aux2   Dilutor ID#2 connected to 'AUX2' interface

note ———————— *The Object List names are identical for both the 'PAL' or 'PAL-xt' Systems, but the PAL Object Lists differs between the 'PAL' and 'PAL-xt' Systems. The example shown below is the PAL System Object List Rev. J.*
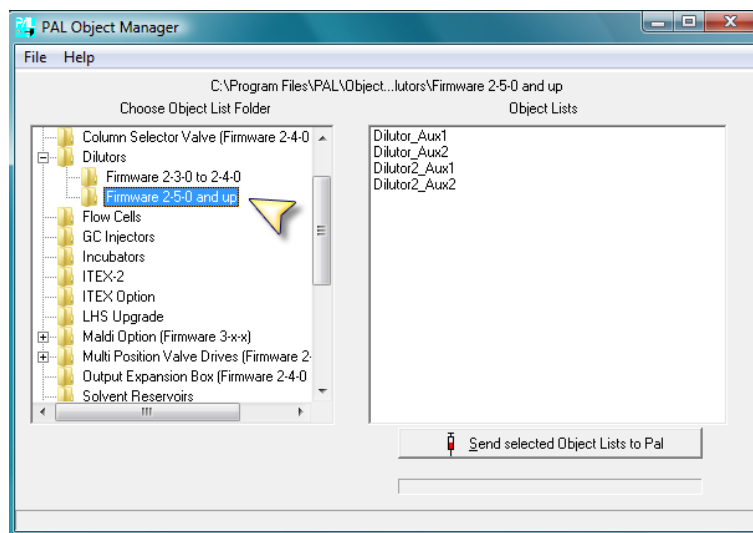
Figure 13. PAL Object Manager 'Choose Object List Folder'

1. Select the folder corresponding to the PAL Firmware version and the Dilutor(s) Option according to the available 'AUX' Interface(s);

2. The Firmware version must be specified due to the new feature enabling the operation of two PAL Dilutor Options installed on the PAL System;
   Please note that this is only valid for the PAL System. The PAL-*xt* System does not require this differentiation;

3. Close the Object Manager software.

3.3. Software Control of PAL Dilutor Option

The PAL Dilutor can only be used together with the PAL Cycle Composer control software or in combination with Cycle Editor for ICC interpretation within another CDS software package.
Make sure your installation meets the hard- and software requirements before operating the Dilutor. (See section 'Installation', point 1.2 'Hardware Requirements', and 1.3. 'Software Requirements').

3.3.1. Installation of Macros for Cycle Composer

note

To operate the PAL Dilutor via Cycle Composer software, it is assumed that the user is familiar with the PAL Cycle Composer control software.

Navigate to the Cycle Composer folder in Explorer. This folder is usually installed in the following path:

C:\Program Files\PAL\Cycle Composer

If a separate Method Folder is desired for the Dilutor, copy the folder 'Dilutor' from the CD to the Cycle Composer folder.

In Cycle Composer, use the menu 'File/Options/Choose method folder…' and select the 'Dilutor' folder as the method folder.

To add the Dilutor macros to an existing method folder, just copy the macro (*.pma) and method (*.pme) files from the 'Dilutor' folder on the CD to the method folder.

Every PAL Dilutor is shipped with a CD ROM containing three different Dilutor application examples (see table below). These examples may be used to become familiar with the Dilutor and may be a good starting point to develop your own applications.
Copy these examples to your Cycle Composer method folder.

Method	Method Description	Macro used	Macro Description
Serial Dilute 200 µL to 96 vials	Dilute 200 µL to a range of samples starting with index set in sample list	Serial Dilute to Tray	Dilute a pre-selected volume to a sequence of samples. The first sample is specified in the sample list.
Add 50 µL Reagent, Dilute with 200 µL and Inject	Add reagent to sample and immediately dilute with solvent. Aspirate sample with mixing strokes and inject into valve. Clean syringe and valve inlet by flushing with Dilutor.	Add Reagent and Dilute	Add reagent to the vial selected in sample list and add solvent with the Dilutor
Inject and Flush Valve with Dilutor	Load sample into syringe, inject to valve and immediately flush syringe and valve with Dilutor.	Flush Injector	Flush an injection valve with the Dilutor using a selectable volume up to 10mL

Table 2. Examples of Dilutor Applications

3.3.2. Installation of ICC-Cycles

If the PAL System is integrated within a data system software that controls the PAL using the Cycle Editor for PAL ICC interpretation (e.g. Analyst, ChemStation, Empower, EZChrom, MassLynx, Xcalibur), an ICC 'Cycle' is used and not the Cycle Composer 'Macro'; the cycle extension is '*.cyx'. Follow the instructions as described above for 'Installation of Macros'. The folder for the cycle is usually located within the data system application folder.

note

A Cycle Composer macro can be converted to a Cycle file format (extension '.cyx') using the Cycle Editor software.
Conversion is possible starting with Cycle Editor Version 1.4.0.4.*

F. PAL Dilutor Option Operation

1. PAL Dilutor Utility Functions

The Dilutor Utility functions, selectable from the Menu screen, provide quick access to Dilutor parameters that may need to be changed (e.g. the prime function or syringe plunger speeds).

note — *The PAL Dilutor must be installed and set up properly before the 'Utility Functions' can be used.*

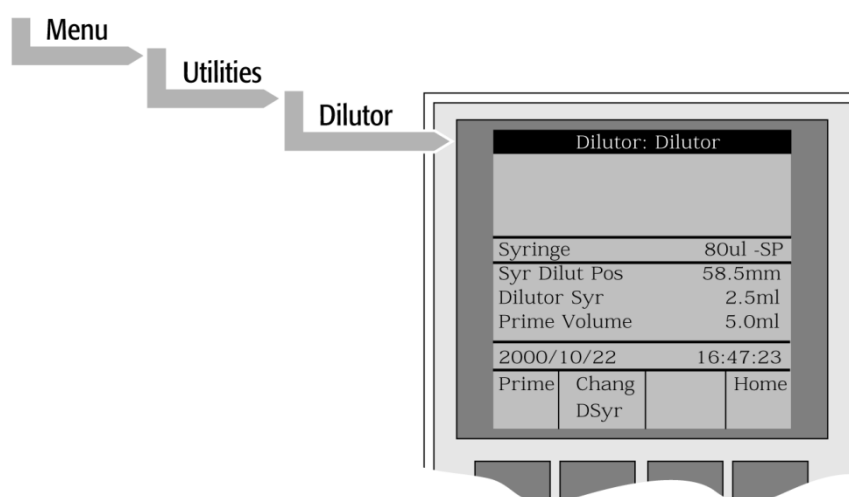Complete the following steps to access to the PAL Dilutor Utility functions:

Figure 14. Menu Screen PAL Dilutor Utilities

By pressing a Function Key the following functions are available:

Function Key	Description
F1 Prime	This Function is used to prime the solvent lines between the solvent bottle and the Dilutor syringe, and the transfer line between the Dilutor syringe and the sideport syringe. After selecting 'F1Prime', the Dilutor syringe aspirates the volume defined in Prime Volume and ejects the solvent to the selected Waste position. Several plunger strokes may be needed, depending on the Dilutor syringe size and Prime Volume. The function is used prior to first time use or after every solvent or syringe change.
F2 Change DSyr	The Dilutor syringe plunger is moved to a position where the syringe can be removed from the Dilutor module. A prompt will display, specifying the new Dilutor syringe. The syringe must be installed before pressing Enter.
F3	Not used
F4 HOME	The Dilutor syringe moves to its Zero position and the Job Queue Menu is displayed.

Table 3. Function Key Allocations

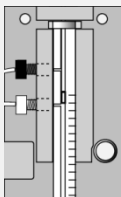The following syringe parameters may be changed by selecting the particular item:

Item	Description
Syringe	Indicates the type of sideport syringe currently used together with the dilutor module.
Syr Dilut Pos	This parameter serves to define the dilute position of the sideport syringe plunger. The position should be adjusted exactly above the lower hole of the sideport syringe. It must be verified after every sideport syringe change. See Figure 15 for details.
Dilutor Syr	Indicates the type (size) of dilutor syringe currently used.
Prime Volume	The volume used to prime the solvent lines between the solvent bottle and the dilutor syringe and the transfer line between the dilutor syringe and the sideport syringe (see page 22, '**F1Prime').**
Pullup Del	Using this item, a delay time between solvent pull-up and ejection while filling the dilutor syringe can be selected. This feature is especially useful for handling viscous solvents.
Fill Speed	Speed of dilutor syringe plunger movement used in all syringe filling operations.
Eject Speed	Speed of dilutor syringe plunger movement used in all syringe eject operations.
Eject Delay	Using this item, a delay time between solvent eject and next solvent pullup of the dilutor syringe can be selected. This feature is especially useful for handling viscous solvents.

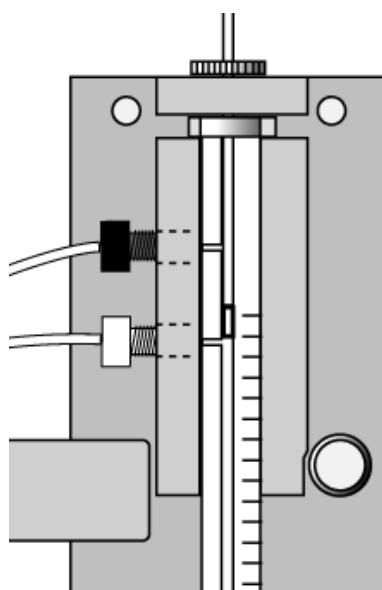**Table 4.** Syringe Parameter and Function Keys

Figure 15. Dilutor Syringe Plunger Position

G. Maintenance

1. Maintaining the Dilutor Syringe

To maintain the Dilutor syringe you can:

- Inspect the syringe plunger seal
- Replace the syringe plunger
- Replace the syringe

The Dilutor syringe plunger requires periodic replacement. The frequency depends on the duty cycles, the type of solvents being run through the syringe and the size of the syringe. Replace the syringe plunger if it leaks or is damaged. To either inspect or replace the Dilutor syringe plunger, complete the following steps to gain access to the Dilutor syringe change utility function (Fig. 16):
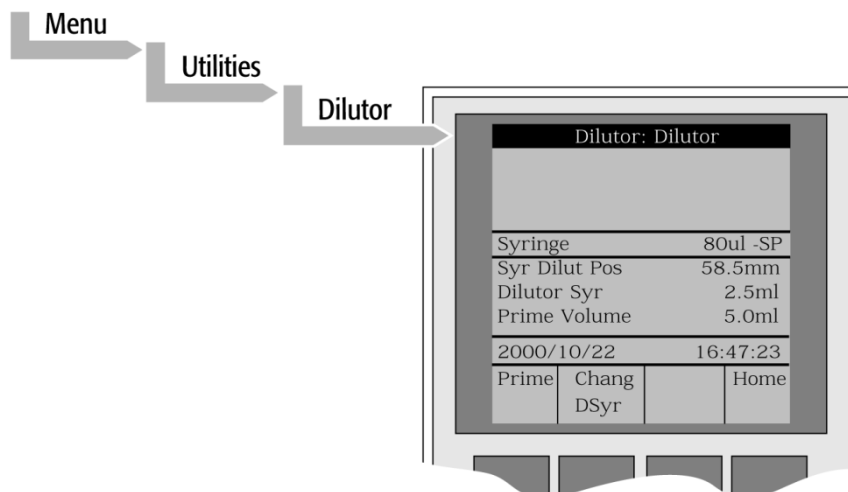

Figure 16. Menu Screen Change Dilutor Syringe

1. Press F2 'Change DSyr'. The Dilutor syringe plunger moves to a mid position of the plunger drive;

2. Remove the Dilutor syringe screw;

3. Unscrew the Dilutor syringe from the Dilutor solenoid valve;

4. Inspect or replace the plunger / syringe;

5. Carefully screw the Dilutor syringe into the lower solenoid valve port again and tighten firmly;

note ———————— *Make sure a PTFE Dilutor syringe washer is inserted ! (see section E, 'Installation', point 2.2.). Do not insert a second washer!*

6. Rotate the syringe barrel and insert the Dilutor syringe screw into the syringe button hole, and screw it into the Dilutor drive pin.

2. Maintaining the Sideport Syringe

To maintain the sideport syringe you can:

- Inspect the syringe plunger seal
- Replace the syringe plunger
- Replace the removable syringe needle
- Replace the syringe

The sideport syringe plunger requires periodic replacement. The frequency depends on the number of working cycles, type of solvent and sample being run through the syringe, and size of the syringe. Replace the syringe plunger if it leaks or is damaged. To inspect or replace the sideport syringe plunger, syringe, or removable syringe needle, complete the following steps:

1. Turn OFF the PAL power supply;

2. Move the PAL Injection unit to a clear position within the working space;

3. Loosen the plunger holder retaining screw (1);

4. Unscrew the sideport syringe adapter screw (5), and remove the sideport syringe assembly from the injection unit;

5. Loosen the two transfer tubing connection fittings (2) but do not remove completely;

6. Loosen the plunger sealing screw (3) and lift up the plunger (4) (make sure the black Perfluor O-ring remains in the plunger sealing screw);
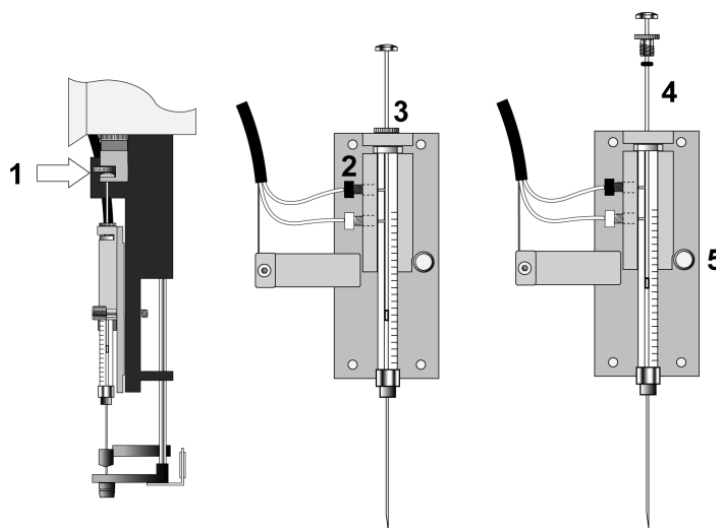
Figure 17. Exchanging the Sideport Syringe

7. Inspect the sideport syringe plunger and / or the removable needle and replace if necessary.

   To install the sideport syringe again, repeat steps 1 – 7.

3. Replacing the Transfer Tubing

1. Unscrew the white connection fitting at the left hand port of the Dilutor solenoid valve;
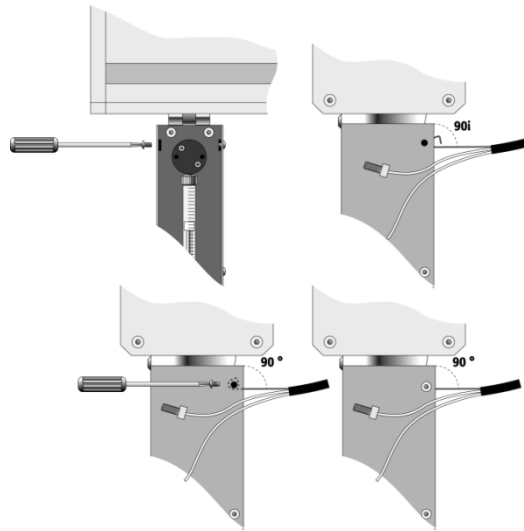

Figure 18. Removing the Transfer Tubing Kit at the Dilutor Side

2. Unscrew the left top Dilutor cover Torx screw and remove the guiding wire;

3. Unscrew the two connection fittings at the guiding bracket of the sideport syringe adapter;

4. Open the Torx screw at the guiding bracket of the sideport syringe adapter;
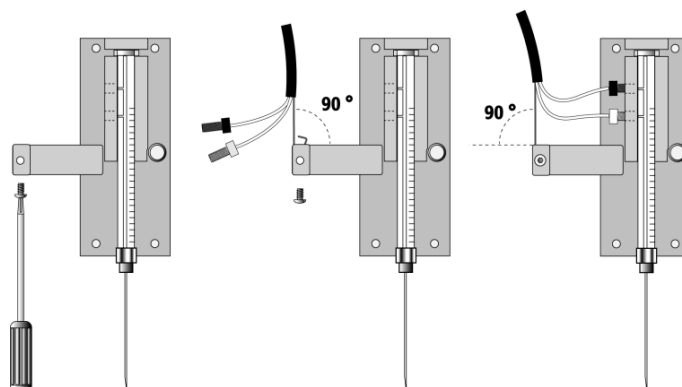
6. Remove the transfer tubing kit.

Figure 19. Removing the Transfer Tubing at the Sideport Syringe

To reinstall the transfer tubing repeat steps 1 – 5.

H. Appendices

1. Definition of Terms

Job Queue

A Job Queue is a list of sample processing Jobs. Jobs are executed in the order displayed on the JOB QUEUE menu screens. New Jobs may be added to the queue while samples are being processed.

Job

A Job contains the information needed by the PAL to process multiple samples by the same processing steps. The elements of a Job are a Method and a Tray that define the location of the samples to be processed. For identification, Jobs are automatically numbered from 01 to 99 and then restart with 01 when they are added to the Job Queue.

Cycle

A Cycle consists of the specific operations necessary to process one sample. The Cycle operations are repeated for each sample within a Job. Cycles are designed for specific applications.

Method

A Method defines how the samples are processed. The elements of a Method are a Cycle, a Syringe and a Parameter List. Methods have names with up to eight characters and can be edited, copied, and deleted.

Method Parameters

Method Parameters are associated with the Cycle operations. User-assigned Parameter values define how a processing operation is performed. A zero Parameter value will disable a Cycle operation. Cycle Parameters are application-specific.

Tray Holder

A Tray Holder can hold one or more trays. Each Tray Holder has a reference position (X-, Y-, Z-coordinates) that defines its location.

Tray

A Tray holds multiple samples. Trays are defined by designating the Tray Type (see below) and the Tray Holder. Tray names are used to identify the sample source within a PAL Job.

Tray Type

A Tray Type defines the pattern and sampling sequence of sample locations within a Tray.

Stack

A Stack is a particular type of Tray Holder that is designed to hold micro-plates. A six-drawer Stack holds 12 standard micro-plates, two in each drawer. A three-drawer Stack holds six deep-well micro-plates, two in each drawer.

PAL Object Manager

Software to load a PAL Object List to an instrument if a Module (hardware module) has been added to the PAL System. In a special mode Object Manager can also be used to create and maintain Object Lists.

PAL Object List

If a PAL Module (hardware) is added to an instrument, several Objects have to be loaded into the firmware. These Objects are collected in an Object List and stored in a file with the extension '*.pol'.
Object Lists are delivered together with Object Manager Software and are grouped into folders for the different kind of Modules (e.g. Syringes, Tray Holders, Valve Drives). The name of an Object List starts with the Module part number with variants added (e.g. first or second Stack). The name of the root folder includes the revision which is dependent on the firmware version (e.g. 'Object Lists Rev. K' for firmware 2.X and 3.X).

Objects

Objects are data structures describing the properties of physical modules. Certain modules (e.g. a Stack) require several objects.

Object Class

Each Object belongs to an Object Class (e.g. Syringes, Trays, Injectors). The Object Class defines the Items of an Object.

Object Item

An Object contains several Items which can be numerical values with a
physical unit (e.g. X-, Y-, Z-Position, Penetration, Syringe Scale Length,
Syringe Volume) or references to other objects. Note that the term
'Parameter' is reserved for 'ATOM Parameter' (PAL Firmware commands
to be used for a PAL Cycle or Macro).

Module

PAL hardware module, either part of a standard PAL configuration (e.g.
COMBI PAL, HTS PAL) or an optional addition (e.g. Cooled Stack, MALDI Tool,
Dilutor).
The term 'Module' is intentionally used to differentiate from 'Object', which is
reserved for the PAL Firmware Object.

2. Naming Convention

This section recommends the standard naming convention for the PAL System. Following these conventions will allow the PAL setup to be pre-configured for certain applications. This simplifies software backups and application development, and improves technical support and training.

Tray Type	Tray Description
VT200	Vial Tray, 200 positions (10 x 20) For 7 mm micro-vials 1 mL
VT98	Vial Trays, 98 positions (7 x 14) For 12 mm vials 2 mL
VT78	Vial Tray, 78 positions (6 x 13) For 7 mm micro-vials, 1 mL (opposite side of 98 positions Tray)
VT54	Vial Tray, 54 positions (6 x 9) For 12 mm vials, 2 mL
VT21	Vial Tray, 21 Positions (7 x 14) For 12 mm vials, 2 mL
VT32-10	Vial Tray, 32 positions (4 x 8) For 23 mm headspace vials, 10 mL
VT32-20	Vial Tray, 32 positions (4 x 8) For 23 mm headspace vials, 20 mL
MT96	Standard 96-position shallow microplate
DW96	Deep well 96-position microplate
MT384	High density 384-position shallow microplate

Table 5. Naming Convention

3. PAL Dilutor Spare Parts

3.1. PAL Dilutor Spare Parts for 'Dilutor Syringe'
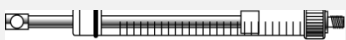
Part No.	Item	Description
SYRC DIL1.0	PAL Dilutor Syringe 1mL	
SYRC DIL2.5	PAL Dilutor Syringe 2.5mL	
SYRC DIL5	PAL Dilutor Syringe 5mL	
SYRC DIL10	PAL Dilutor Syringe 10mL	
PLGDil1.0	Replacement Dilutor Syringe plunger 1mL	
PLGDil2.5	Replacement Dilutor Syringe plunger 2.5 mL	
PLGDil5.0	Replacement Dilutor Syringe plunger 5 mL	
PLGDil10	Replacement Dilutor Syringe plunger 10 mL	
DilWasher	1 pc PTFE Dilutor washer	
PAL SyrOringSP80	1 pc Perfluor O-Ring	

Table 6. PAL Dilutor Spare Parts 'Dilutor Syringe'

3.2. PAL Dilutor Spare Parts for 'Sideport Syringe'

Part No.	Item	Description
PAL SyrLCSP80	Sideport Syringe Kit 80µL 3 pcs needles gauge 22 point style 3, for HPLC technique	Kit LC Syringe SPxxµl for PAL, consisting of: 1 pc syringe adapter 1 pc plunger holder 1 pc syringe SYRC SPxx-R 3 pc removeable needle 1 pc plunger sealing screw 1 pc perfluor o-ring
PAL SyrLCSP20	Sideport Syringe Kit 20 µL 3 pcs needles gauge 22S point style 3, for HPLC technique	
PAL SyrLCSP800	Sideport Syringe Kit 800 µL 3 pcs needles gauge 22 point style 3, for HPLC technique	
PAL SyrLCSP800-19	Sideport Syringe Kit 800 µL 3 pcs needles gauge 19 point style 3, for HPLC technique	
PAL SyrGCSP80	Sideport Syringe Kit 80 µL 3 pcs needles gauge 26 point style 3, for GC technique	
PAL SyrGCSP20	Sideport Syringe Kit 20 µL 3 pcs needles gauge 26S point style 3, for GC technique	
SyrC SP800-R	Sideport Syringe 800 µL gastight, screw mount for removable needle. Needles not included.	
SyrC SP80-R	Sideport Syringe 80 µL gastight, screw mount for removable needle. Needles not included.	
Syrc SP20-R	Sideport Syringe 20 µL gastight, screw mount for removable needle. Needles not included.	
SyrC SP4-R	Sideport Syringe 4 µL gastight, screw mount for removable needle. Needles not included.	
PLG SP800	1 pc. Replacement syringe plunger for 800 µL Sideport syringe	
PLG SP100	10 pcs. Replacement syringe plunger for 80 µL Sideport syringe	
PLG SP25	10 pcs. Replacement syringe plunger for 4 and 25 µL Sideport syringe	

Table 7. PAL Dilutor Spare Parts ' Sideport Syringe'

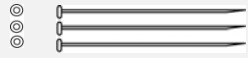## 3.2. PAL Dilutor Spare Parts for 'Sideport Syringe' (contd.)
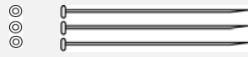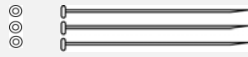
Part No.	Item	Description
Ndl S-22-3	3 pcs. Replacement needles gauge 22 point style 3 for Sideport syringe HPLC Technique	
Ndl S-22S-3	3 pcs. Replacement needles gauge 22S point style 3 for Sideport syringe HPLC Technique	
Ndl S-19-3	3 pcs. Replacement needles gauge 19 point style 3 for Sideport syringe (80 µL) HPLC Technique	
Ndl L-19-3	3 pcs. Replacement needles gauge 19 point style 3for Sideport syringes >100µL (SP800) HPLC Technique	
Ndl S-26-AS	3 pcs. Replacement needles gauge 26 pointstyle 'AS' for Sideport syringe GC Technique	
Ndl S-26S-AS	3 pcs. Replacement needles gauge 26S pointstyle 'AS' for Sideport syringe GC Technique	
Ndl S23-AS	3 pcs. Replacement needles gauge 23 pointstyle 'AS' for Sideport syringe GC Technique	
Ndl S23S-AS	3 pcs. Replacement needles gauge 23S pointstyle'AS' for Sideport syringe GC Technique	
MM 30-36	Dilutor syringe screw	
MSU 30-14	1 pc Sideport Syringe gland screw for SyrC SP80-R, SyrC SP20-R or SyrC SP4-R	
MSU 30-16	1 pc Sideport Syringe gland screw for SyrC SP800-R	
MSU 30-17	1 pc Sideport Syringe gland screw for SyrC SP500-R	
MSU 30-18	1 pc Sideport Syringe gland screw for SyrC SP250-R	
PAL SyrOringSP20	O-Ring for SyrC SP20-R or SyrC SP4-R; Perfluor	
PAL SyrOringSP80	O-Ring for SyrC SP80-R; Perfluor	
ORing 3.68x1.78 GA-65	O-Ring for SyrC SP800-R;	

Table 7 (contd.). PAL Dilutor Spare Parts ' Sideport Syringe'

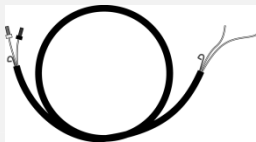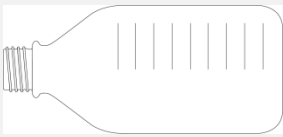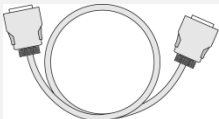## 3.3. Various Spare Parts for PAL Dilutor Option
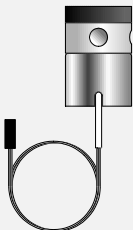
Part No.	Item	Description
PAL TubeDilutor	Transfer tubing kit	
PAL TubeDilHTX	Transfer Tubing kit for 120 cm X-Axis	
PAL DilAspKit	FEP Solvent line incl. Glass Filter, 40 µm pore size	
1000-SV	Dilutor Solvent bottle 1000mL	
Cbl RS20R-760	Cable 20p shielded, MiniRibbon connectors, 760mm long	
MM 90-02	3-way Dilutor Solenoid Valve; PCTFE. PCTFE = Polychloro-trifluoroethylene, also known as KEL-F®; standard 3-way Dilutor Valve.	
MM 90-03	3-way Dilutor Solenoid Valve; PTFE. Optional 3-way Dilutor Valve, compatible with solvents as Toluene, THF or DMSO.	

Table 8. Various Spare Parts for PAL Dilutor Option

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