
Clarity Hardware
CB11 control board

ENG

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1 Brief Description

1.1 D/A card CB11

The **CB11** card is designed for controlling LC pumps (that can be steered by frequency or voltage) by means of the chromatographic station **Clarity**.

The internal **ISA** control board **CB11** contains four 14-bit D/A converters, three *frequency converters* and eight *digital outputs*.



Fig. 1. CB11

Instrument control has been incorporated directly in the **Clarity** program. Control is accessible from the **Method Setup – LC Control** dialog accessible from the **Instrument** window to which the controlled instrument is connected.

1.2 Hardware and software requirements

The **CB11 LC Control Board** for ISA slot can be used with **Clarity** software under following operating systems: **MS Windows 98/Me/ NT/ 2000**.

The **CB11** can also be used with **CSW32** stations.

**The PC must have:**

- Free **ISA** slot for your CB11 board.

2 Installation

2.1.1 The CB11 Card

- The **Clarity** station communicates with the **CB11** card through a selected base address. The default value on the card is **310H**. Because it is not possible to automatically configure the address **CB11** card, it may be necessary to change the base address.

Caution!

*The base address must not be the same as that of the **INT5** card, or the same as that of any other device.*

The base address configured on the card must match the base addressed configured in the program.

On the card, the relevant values can be configured using mechanical jumpers (see **4.1** - Jumper setting on pg. **16**).

- Switch off the **PC**.
- Insert the **CB11** card into the **ISA** slot.
- Start up the **PC**.
- Start up the **Clarity** station, open the dialog **System Configuration** and double-click on the item **CB11 Pump Driver** (if this item is missing, add it by the **Add** button).
- In the field **Base Address** enter the value set using the jumpers on the card and click on the **Apply** button.
- The **Status** line should read **OK**. In the event of a conflict, you will find there a description of its possible cause.

2.2 Device setup and wiring

Standard package is shipped with 3 meter cable for two frequency and two analog (voltage) outputs.

Different cable can be provided upon request.



2.3 Clarity configuration

- Start the **Clarity** station with the  icon on the desktop.
- Invoke the **System Configuration** dialog using the **System – Configuration** command.
- Press the **Add** button  to invoke the **Available Control Modules** dialog.

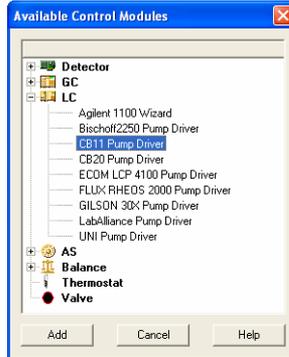


Fig. 2. Available Control Modules

- Select the **CB11 Pump Driver** and press the **Add** button .
- The **Digital/Analog LC driver setup** dialog will appear.

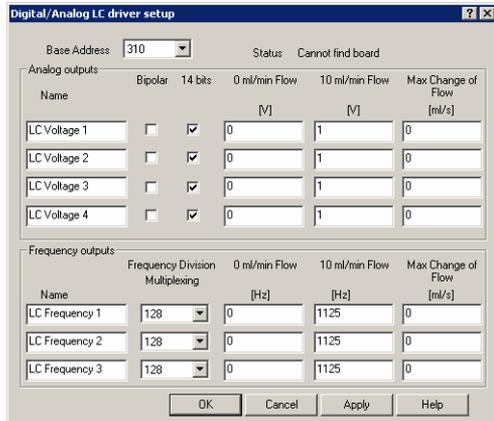


Fig. 3. Digital/Analog LC driver setup



- Select the **Base Address** – it must correspond to the jumpers setting on the card.

Note: For details on setting the correct **Base Address** see chapter 4.5 - **Table of recommended base address** on pg. 18.

- Set the parameters of the **Voltage** or **Frequency** driven pumps (for details see 3.3 - **CB11 Board Config Dialog box** on pg. 12).

The *CB11 Pump Driver* will appear in the **Setup Control Modules** ③ list of the **System Configuration** dialog.

- Switch to the Clarity **Instrument** tab ④ where the LC control will be used. The **Instrument Type** must be set to **LC** ⑤.
- Drag the corresponding **LC Voltage** or **LC Frequency** control channels from the **Setup Control Modules** list on the left side to the desired **Instrument** tab on the right side (or use the --> button ⑥ in the center).

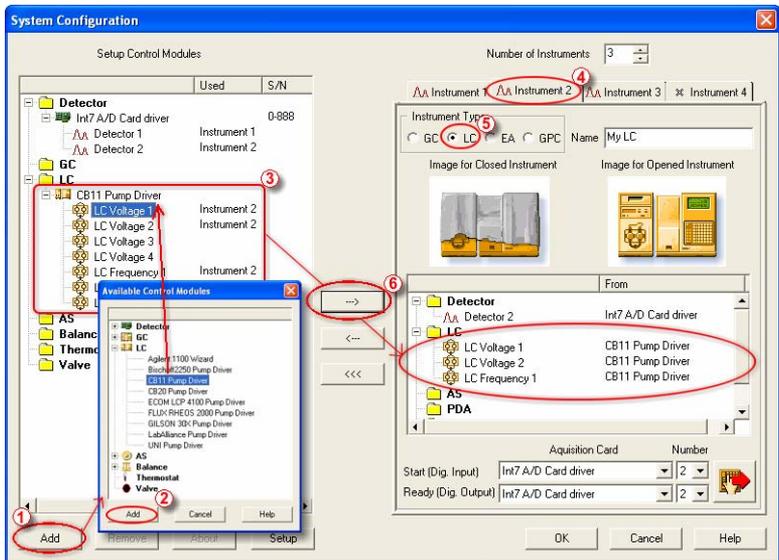


Fig. 4. System Configuration

Note: The **Digital/Analog LC driver setup** dialog can be displayed any time by double-click on **CB11 Pump Driver** icon or using the **Setup** button.



3 Using the CB11 Board

New **LC Control** tab appears in the **Method Setup** dialog, enabling the setting of the LC control method.

3.1 LC Pump Control

The **Method Setup – LC Control** dialog serves for setting up the LC related part of the template method opened in the **Instrument** window.

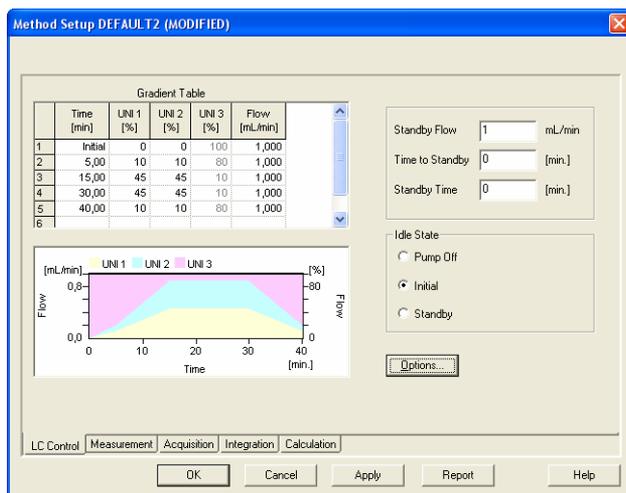


Fig. 5. Method Setup – LC Control

Graph

The graph depicts the percentage of components as a function of time together with the overall flowrate. Data are taken over from the **Gradient Table**. Changes effected in this table are immediately reflected in the graph. Assignment of colours to individual components is shown in the header. The assignment is fixed and individual components are displayed in the graph from bottom to top.

The flowrate is displayed in black.

The graph has two vertical axes: the axis on the left refers to the mixing ratio, that on the right to the overall flowrate.



Gradient Table

A table for setting the composition of the mobile phase and the overall flowrate as a function of time. Operation is analogous to that of spreadsheets (Excel, Quatro Pro, ...). Upon clicking a cell by the left mouse button that cell is highlighted by dots and ready to receive values. A cell that fails to highlight is not available for editing.

Time [min.]

The entered value represents the time at which the ratio of flowrates and the overall flowrate correspond to the values entered in the corresponding row. (These values vary continuously from one time to the next in a manner ensuring that the conditions specified in the next row are satisfied).

XXX1 (.4) [%]

Represents the percentage of a component. The designation **XXX1-4** is in fact replaced by the name of the component (items **Solvent 1 - 4** in the **Gradient Options** Dialog box). Should you enter a component value such that the sum of all values exceeds 100 %, the percentage in the last column is automatically adjusted; if the percentage of the last compound is already zero, the value of the currently entered component is adjusted instead. The flowrate of a compound is calculated by multiplying the overall flowrate (indicated in the **Flow** column) by the corresponding percentage divided by 100.

Flow [ml/ min]

Indicates the overall flowrate through the column. The entered value applies to the time specified in the corresponding row.

Note: *If the flowrate set for the given pump in gradient table (calculated from percentage and total flow) will exceed the maximum flowrate for the set pump head, the change will be ignored and last acceptable value will be used instead.*

Parameters

Standby Flow

Indicates the overall flowrate through the column in the **STANDBY** state reached after the last row of the table has been performed and the **Time to Standby** has passed. The time period during which the flowrate is so maintained is defined by item **Standby Time**. (The ratio of individual components in the respective **STANDBY** and **IDLE** states is given by the first row of the Table (the **Initial** row).

**Time to Standby [min]**

Indicates the time during which the flowrate varies continuously between the last values entered in the table and the value defined by *Standby Flow*. This time is included in the analysis time (the *CONTROL* state).

Standby Time [min]

The time during which the flowrate is maintained at *Standby Flow*. This time is included in the analysis time (the *CONTROL* state).

Idle State

An item specifying the overall flowrate through the column outside the instrument method. The following states are possible:

Pump Off

The flowrates of all components are zero.

Initial

The flowrate is defined by the first row of the gradient table (the **Initial** row).

Standby

The flowrate is the same as in the *STANDBY* mode and, accordingly, corresponds to the value entered in **Standby Flow**.

The *IDLE* state enters into effect each time an instrument is opened, at the end or after abortion of an analysis by the **Abort** command, and is maintained also when the **Clarity** program is shut down.

The mixing ratio of individual components in both the *IDLE* and *STANDBY* states is given by the first row of the gradient table (the **Initial** row).



3.1.1 Options

By invoking the **Options** button in the **Method Setup – LC Control** dialog, the **Gradient Options** dialog will appear.

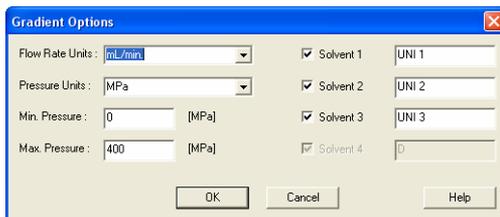


Fig. 6. Gradient Options

In this dialog, the **Flow Rate** and **Pressure** units can be selected, the pressure limits set and **Solvents** can be enabled and named.

Use new method command and set the number of solvents first. For already existing methods, the solvents not configured on instrument are disabled.

3.2 LC Monitor

The pump status window can be invoked using the **Monitor - LC Chromatograph** command from the **Instrument** window or using the  **LC/GC Monitor** icon from the **Instrument** window.

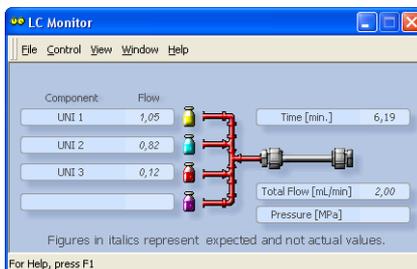


Fig. 7. LC Monitor

This window provides actual condition sent to the pumps.

The pump can be stopped from this dialog by using the **Control - Stop** command or by the  icon. This will stop the pump only, the analysis run is continuing and must be stopped or aborted from the



Data Acquisition or **Single Analysis** dialogs. The flow will be resumed by using the **Apply** or **OK** buttons in the **Method Setup** dialog.

The individual solvent flow can be displayed either in flow units or as a percentage of total flow by checking the **View - Component flow in %** command.

3.3 CB11 Board Config Dialog box

The **Digital/Analog LC driver setup** dialog sets the parameters of the CB11 LC control board. The dialog is accessible only from the **System Configuration** dialog see **2.3 - Clarity configuration** on pg. **6**.

Digital/Analog LC driver setup					
Base Address		310		Status: Cannot find board	
Analog outputs					
Name	Bipolar	14 bits	0 ml/min Flow [V]	10 ml/min Flow [V]	Max Change of Flow [ml/s]
LC Voltage 1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	0
LC Voltage 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	0
LC Voltage 3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	0
LC Voltage 4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	1	0
Frequency outputs					
Name	Frequency Division Multiplexing	0 ml/min Flow [Hz]	10 ml/min Flow [Hz]	Max Change of Flow [ml/s]	
LC Frequency 1	128	0	1125	0	
LC Frequency 2	128	0	1125	0	
LC Frequency 3	128	0	1125	0	

Fig. 8. Example of CB11 Board Config Dialog box

Base Address

The base address for communication between **Clarity** and the **CB11** board.

The address is shown as a hexadecimal number and must correspond to the Jumper setting on the board (see **4.1 - Jumper setting** on pg. **16**).

Available values are described in the **4.5 - Table of recommended base address** on pg. **18**.

Caution!

The occupied address space (8 addresses starting from the base address) must not overlap with the address space of any other equipment.



Status

Describes the status of communication between the Clarity and the CB11 boards.

Status of communication

OK	The board has been detected on the specified base address and is functioning properly
Cannot find board	The most probably reason for this message is wrong base address setting. Re-check the Base Address field, it must match the jumper setting on the board (4.1 - Jumper setting on pg. 16). The board may be also damaged, not properly installed in the slot, or there may be a HW conflict with another device.
DEMO Mode	In case of missing or incorrectly installed acquisition device (INT5, INT7, PAD) or missing hardware key, the CB11 board will switch itself automatically into demo mode.
EVAL	If you have CB11 board running in the computer with installed Clarity Eval .

Analog outputs

The CB11 board contains four converters for controlling HPLC pumps by means of voltage. Some boards do not support any analog outputs. These boards can be used only for frequency-controlled pumps.

Name

You can set a custom name of the pump.

Bipolar

By checking this checkbox you specify, whether the pump requires also negative voltage for its control.

Note: *This option must correspond to the setting of the **J11-J14** jumpers (see **4.1 - Jumper setting** on pg. **16**).*

14 bits

DataApex has been supplying two types of CB11 boards. The older boards used **12 bit** D/A converter. The newer boards support **14 bit** converters.

It is important to set the correct option, while otherwise the board will operate, but with different values!

The CB11 boards supplied before the year 1999 are equipped with the 12-bit converter.



The boards supplied after 1999 utilize 14-bit converter.

The type can be determined from the production No in the **About** dialog (in the **System Configuration** select the **CB11** item and click the **About** button.)

Board SN	D/A Converter
1 - 34	12 bit
> 35	14 bit

If you are not sure which type of D/A you have, contact our technical support.

0 ml/min Flow

Sets the voltage corresponding to the 0 ml/min flow.

10 ml/min Flow

Sets the voltage corresponding to the 10 ml/min flow.

Max change of Flow

Some pumps are not capable to handle commands for sudden change of flowrate (e.g. even switching the flowrate to zero at the end of the analysis could cause a problem.)

Here you can set the maximal change of flowrate that your pump would be able to process. All prospective sudden changes of flow in the gradient program will be automatically staggered into steps, thus protecting your pump.

Frequency outputs

The CB11 board contains three converters for controlling HPLC pumps by means of frequency.

Name

Sets a custom name of the pump.

Frequency Division Multiplexing

The range of frequencies for controlling pumps is very large. **CB11** is able to cover the whole range by means of multiplexing the base frequency.

The Setting of frequency Division multiplexing must correspond to the **F1-F3** jumper setting (see **4.1 - Jumper setting** on pg. 16).

0 ml/min Flow

Sets the frequency that corresponds to the 0 ml/min flow.

**10 ml/min Flow**

Sets the frequency that corresponds to the 10 ml/min flow.

Max change of Flow

Some pumps are not capable to handle commands for sudden change of flowrate (e.g. even switching the flowrate to zero at the end of the analysis could cause a problem.)

Here you can set the maximal change of flowrate that your pump would be able to process. All prospective sudden changes of flow in the gradient program will be automatically staggered into steps, thus protecting your pump. (e.g. the empirical values for Waters 501-510 HPLC pumps have to be less than 1 ml/sec.



4 Tables and specifications

4.1 Jumper setting

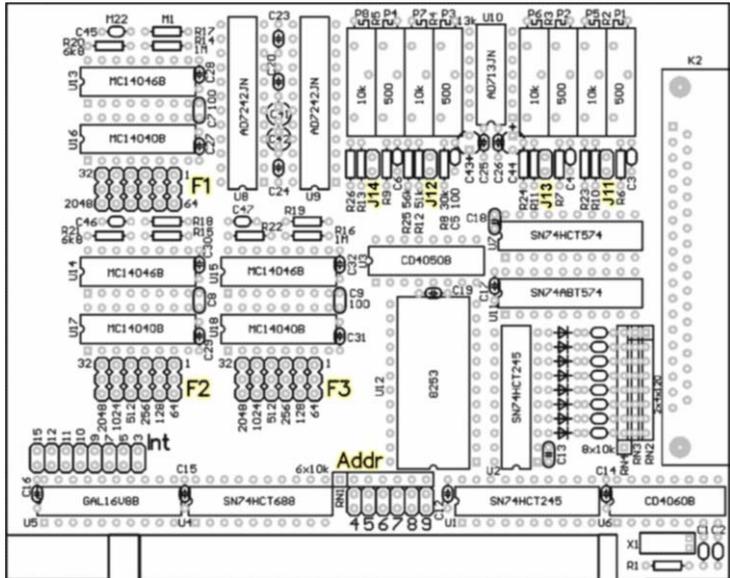


Fig. 9. CB11 jumper locations

Addr

Sets up the base address. Six jumpers corresponding to addresses **A4** - **A9** are provided.

Closed jumper represents logical 0.

The set address must differ from the address of the **INT5** card and must correspond to the address set in the **Digital/Analog LC Driver Setup** dialog (see **3.3 - CB11 Board Config Dialog box** on pg. 12).

Default address is **310H**.

See the **4.5 - Table of recommended base address** on pg. 18.

Int

Not used. Leave it disconnected!

**J11-J14**

Unipolar (0 - 10 V) or bipolar (-10V - +10 V) output of the D/A converters. The jumper sets unipolar output.

J11 - Voltage channel 1

J12 - Voltage channel 2

J13 - Voltage channel 3

J14 - Voltage channel 4

Default setting is unipolar in all channels.

F1 - F3

Defines the frequency range of the corresponding frequency converter.

F1 - Frequency channel 1

F2 - Frequency channel 2

F3 - Frequency channel 3

Default setting is jumper **32**.

See the **4.6 - Table of permitted frequency ranges** on pg. **19**.

4.2 Technical data:

Voltage range	-10 V +10 V
Frequency range	0.03 Hz - 100 kHz
Design	ISA board

4.3 Allowed maximum output load:**Maximum output current**

Voltage outputs	10 mA
Frequency outputs	2.5 mA at HIGH state, 8 mA at LOW state
Digital outputs	30 mA at HIGH state, 60 mA at LOW state



4.4 CB11 connector

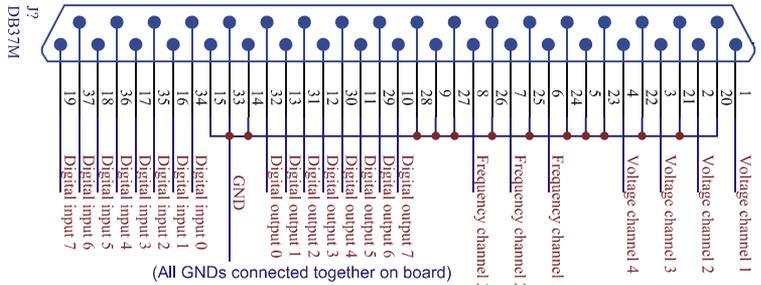


Fig. 10. CB11 connector

4.5 Table of recommended base address

Base address	Jumpers	Reserved for
300H	4,5,6,7	Prototype card
310H	5,6,7	Prototype card
320H	4,6,7	? (PC XT harddisk)
200H	4,5,6,7,8	Game port
210H	5,6,7,8	Expansion box
220H	4,6,7,8	?



4.6 Table of permitted frequency ranges

Jumper	Max. frequency [Hz]	Min. frequency [Hz]	Min. increment [Hz]
1	320 000	128	64
2	160 000	64	32
4	80 000	32	16
8	40 000	16	8
16	20 000	8	4
32	10 000	4	2
64	5000	2	1
128	2500	1	0.5
256	1250	0.5	0.25
512	625	0.25	0.125
1024	315.5	0.125	0.0625
2048	156.25	0.0625	0.0313