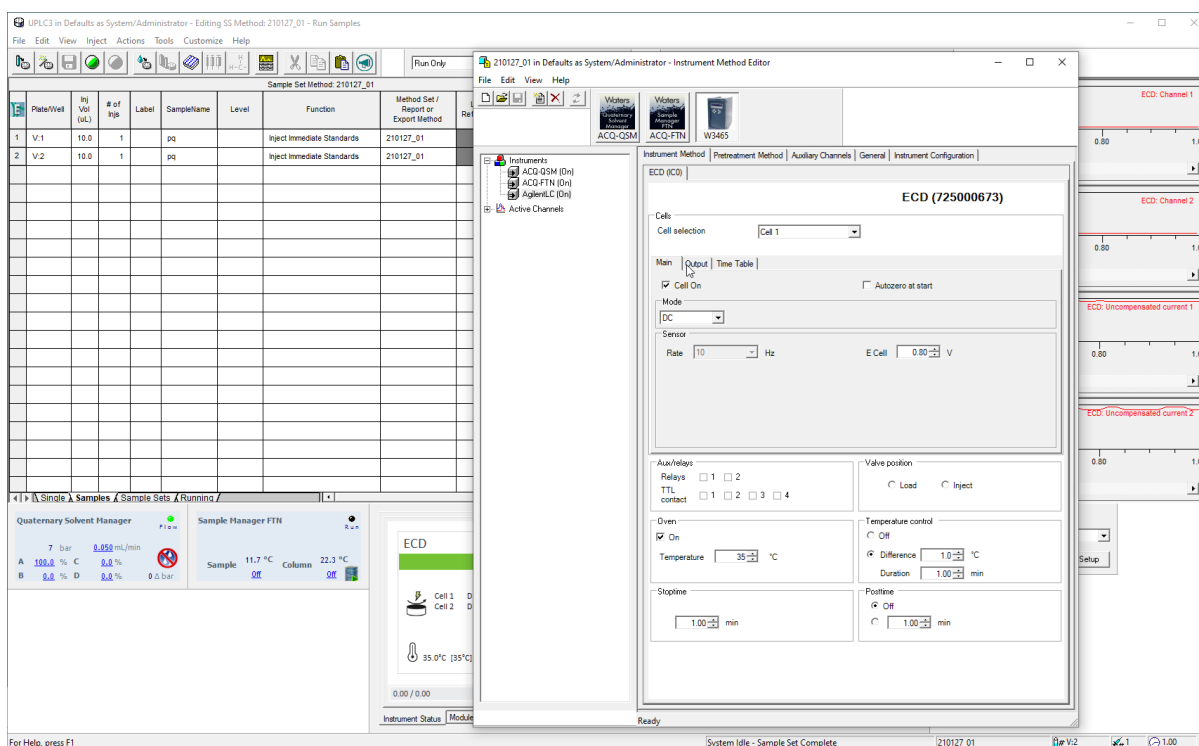


Waters 3465 ECD driver for Empower 3

User Manual

176.0112, Edition 12, 2026



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In this guide

This installation guide is designed to help users install the RC.NET-based driver for the Waters 3465 ECD for use with Empower 3 CDS software.

For further information regarding the Waters 3465 ECD, please refer to the User's Guide that was originally shipped with the unit.

Terms and Abbreviations

Terms and Abbreviations used in this document

| Term | Description |
|--------|--|
| ECD | Electrochemical Detection |
| CDS | Chromatography Data System |
| RC.NET | An Instrument Driver Control Framework developed by Agilent, also known as 'ICF' |
| ICFSL | Agilent Instrument Control Framework (ICF) Support Layer for Waters instruments |

1. Introduction

This user guide covers the installation and operation of the Waters 3465 ECD control driver for Empower CDS. The driver has been developed by Antec Scientific and supplied to Waters Corporation for distribution with Empower CDS.

Version history

| Date | version | Empower CDS | OS | description |
|-----------|--------------------|-------------|------------|--|
| 3/3/2021 | 1.3.1.21054 | 3 | Win 10 Pro | Initial release |
| 5/21/2021 | 1.3.2.21140 | 3 | Win 10 Pro | Update |
| 10/7/2021 | 1.3.3.21278 | 3 | Win 10 Pro | Addition of external trigger |
| 2/2/2023 | 1.3.4.22342 | 3 | Win 10 Pro | New installer requirements |
| 4/25/2024 | 1.3.5.24116 | 3 | Win 10 Pro | New WICF 4.0, fix for SVT not showing driver |

Software platform prerequisites

Empower 3 CDS

Agilent support layer for Waters ICFSL 3.7

Supported instruments

Waters 3465 ECD with FW 1.09 (and newer)

Supported OS

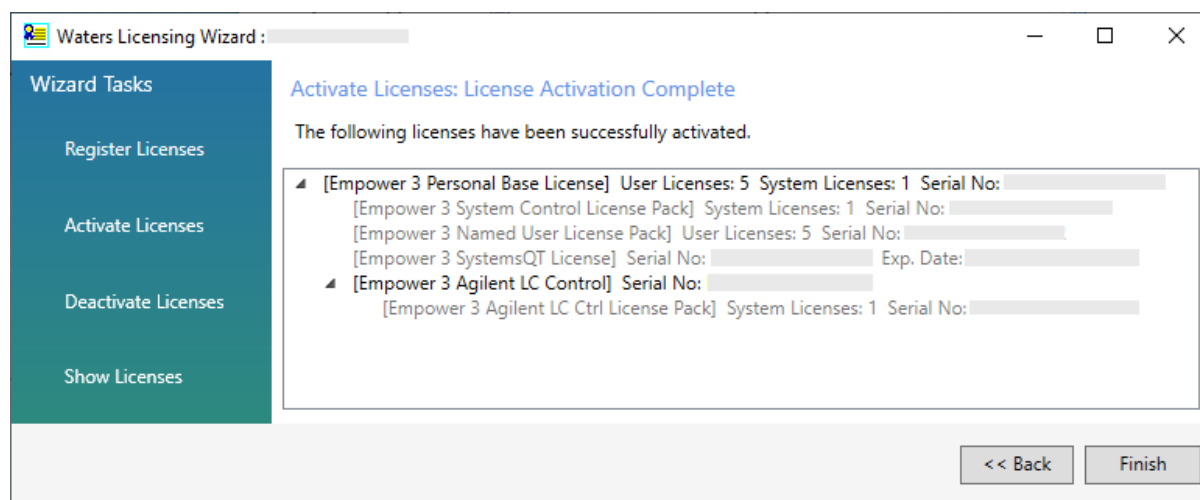
Windows 10 Professional 64/32 bits, language English only, regional settings: US English.

Driver licensing

The following 3 licenses should be in place for successful installation and operation.

1. Empower 3 license, extended with
2. Empower 3 Agilent LC Control License

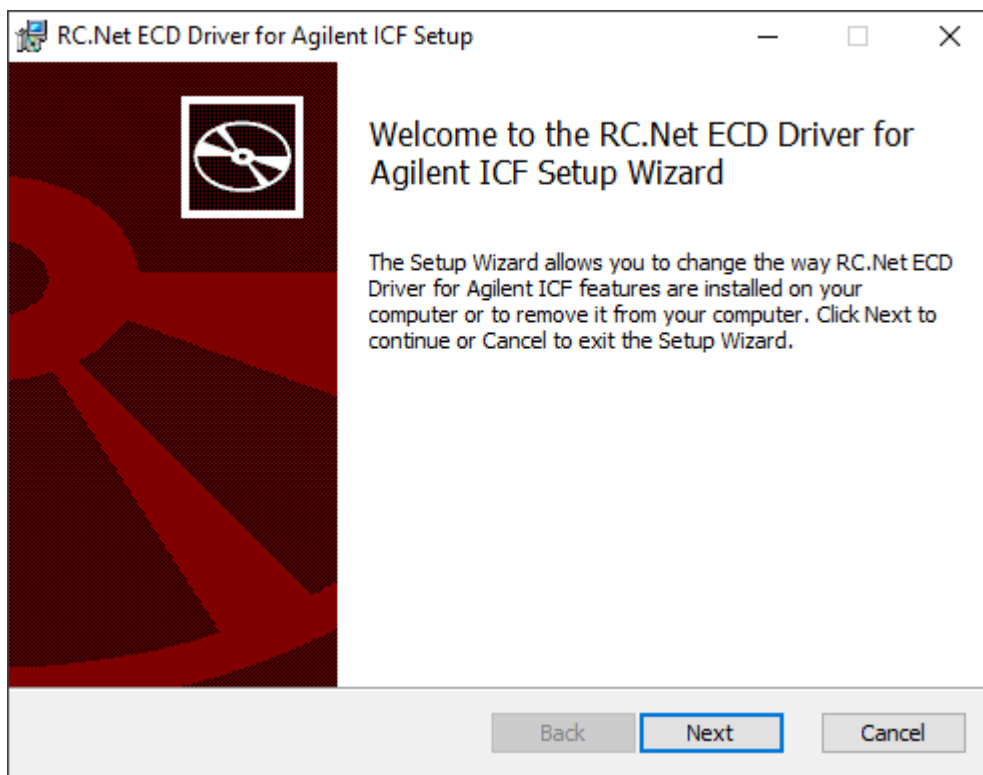
In addition to the software licenses, a Waters 3465 ECD has a factory set license bit. Before attempting to install the ECD driver for Empower, start the Waters Licensing Wizard and check for the appropriate licenses to be activated.



2. Installation

The Waters 3465 ECD device driver for Empower can be downloaded from [Antec's website](#). Download and unzip the files from the package and follow these steps.

1. Log on to the PC with a local Administrator account and privileges.
2. In case Empower CDS is running, close it, restart the PC and login again. It is important that Empower is not running, and no services are locking any files.
3. De-install previous versions of the driver before attempting an installation.
4. Unzip the downloaded file and start the executable W3465_Empower_x_x_x_x.msi.
5. Follow the installation instructions on the PC screen.



Verify the driver installation

To verify the driver installation was successful, run the Software Verification Tool to obtain a report.

- 1 Go to Start > All Programs > Agilent Technologies > Software Verification Tool.
- 2 Check for a PASS in the report, and ensure that the Waters 3465 ECD driver entry is present.

Note: when upgrading from a previous version of the driver, restarting the PC is necessary before starting Empower.

Connect the ECD to the PC

Follow the instructions from the ECD user manual to connect the instrument to the PC. The device can be connected through LAN. The procedure for USB connection is not described here.

Note:

1. USB connection is only possible after first creating a LAN device in the Agilent PreConfiguration tool. The procedure requires a few additional steps and will be described in a Knowledge base paper on our website.
2. When switching between USB and LAN cable, always take out the cable that is not being used. The ECD must be switched off/on. Apply only one cable at a time, to avoid initializing a port that is not being used!

ECD device driver

The ECD device driver has three sections: **Configuration**, **Method** and **Status**. The ECD configuration is accessed from the CDS Control Panel, the Method and Status menu is accessible after 'Launch' of an instrument with the ECD.

Configuration: parameters are the connection port, serial numbers, valve present, CRC checksum, and units. These are parameters that are not likely to change much between methods.

Method: parameters are all operational settings such as measurement mode, range, potential and so on. These parameters are usually different for each new method.

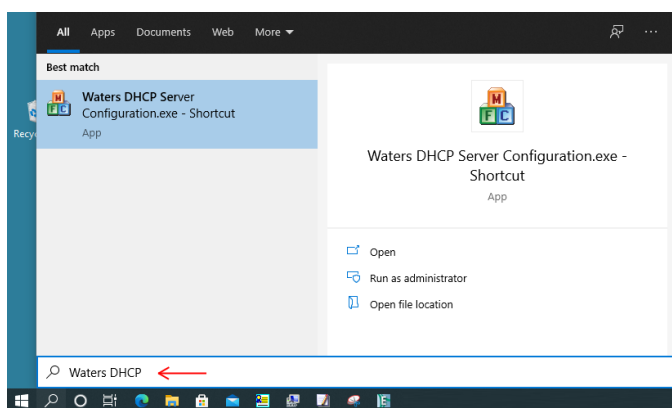
Status: reflects the relevant device parameters actual status.

3. Configuration

To install and create a new system with the Waters 3465 ECD, a few things have to be taken care of in advance.

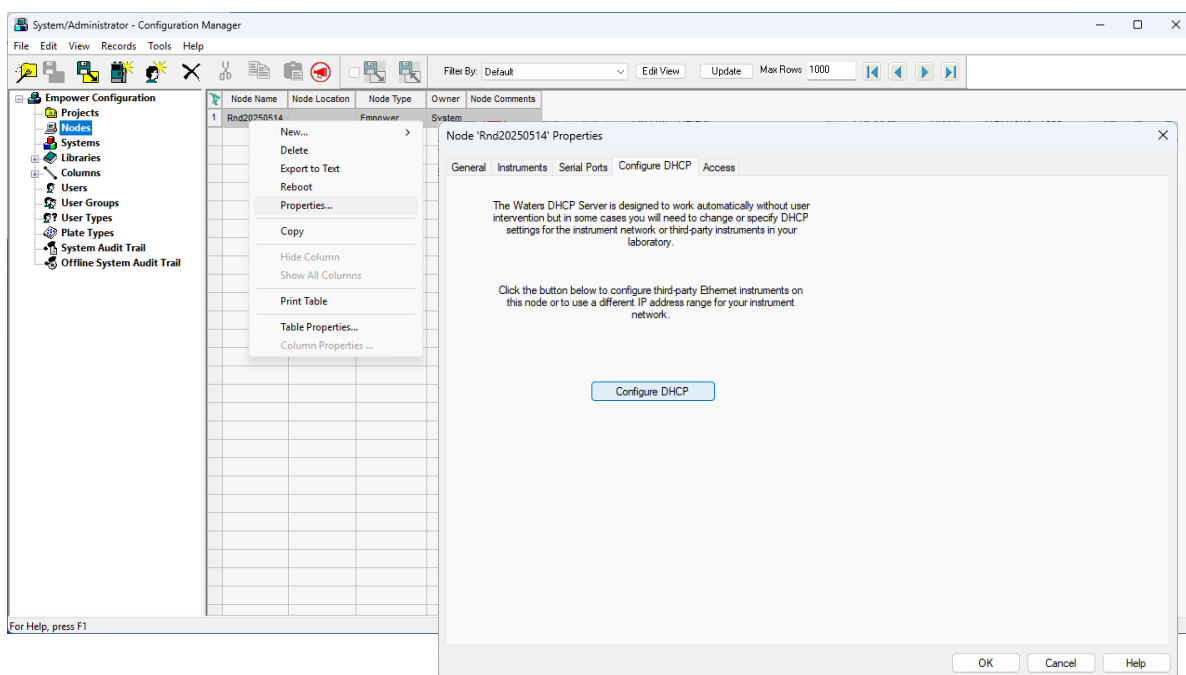
1. First, the ECD must be added to the Waters DHCP Server Configuration.
2. Second, the ECD must be configured using the Agilent PreConfiguration tool.

When done, the HPLC system can be configured in the Configuration Manager.



One way to locate the Waters DHCP Server Configuration program is by entering the name in 'Search' in the Windows task bar.

Starting from ICFSL version 4.0, the DHCP Server Configuration is integrated into the Configuration Manager in the Empower software. It is accessible by going to the Node Properties and proceed to the tab Configure DHCP.



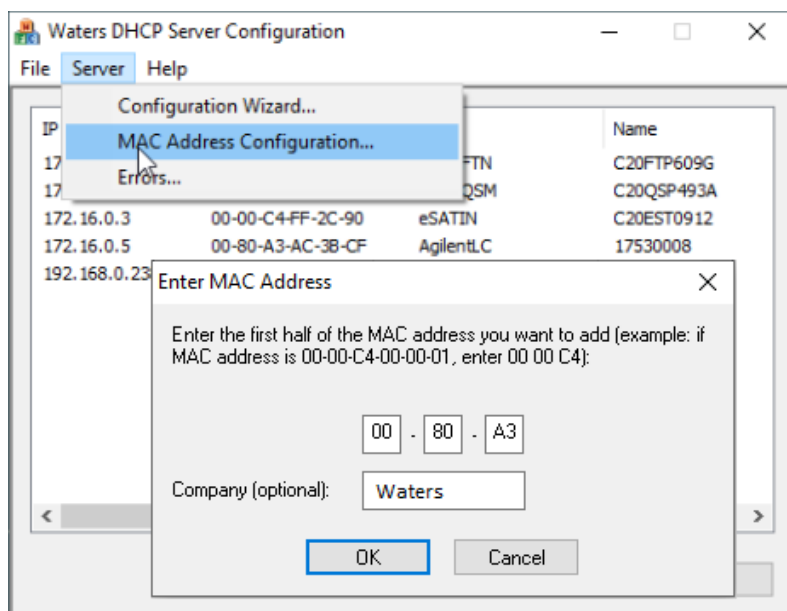
Note:

In case of installation with version of ICFSL < 3.7, the driver must be installed as “AgilentLC” type device. The “W3465” device type is only working from ICFSL version 3.7 and newer.

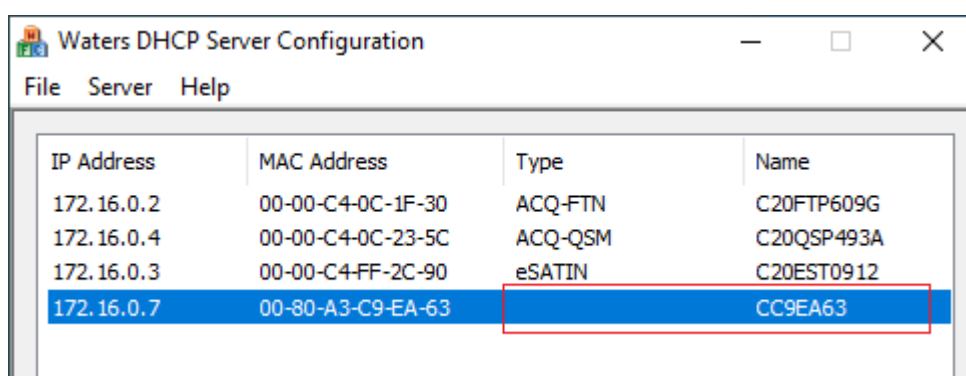
Waters DHCP Server Configuration – ECD with IP set to ‘DHCP’

The Waters 3465 ECD is normally delivered with IP address set to ‘DHCP’. This means the device will receive the IP address from the Waters DHCP server. In order to make the server to assign an IP address, the MAC address range must be filled in first.

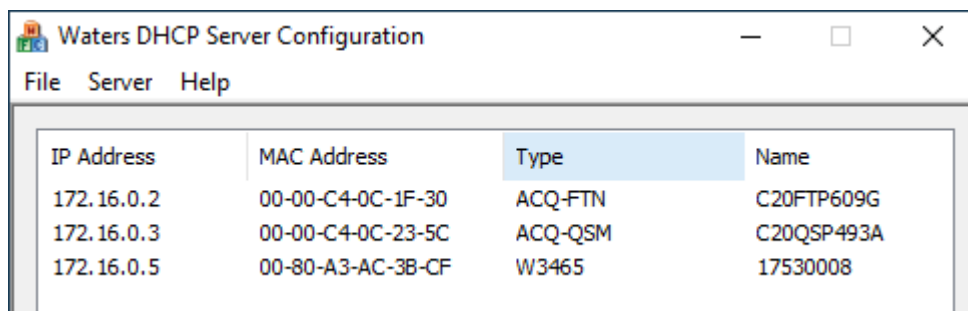
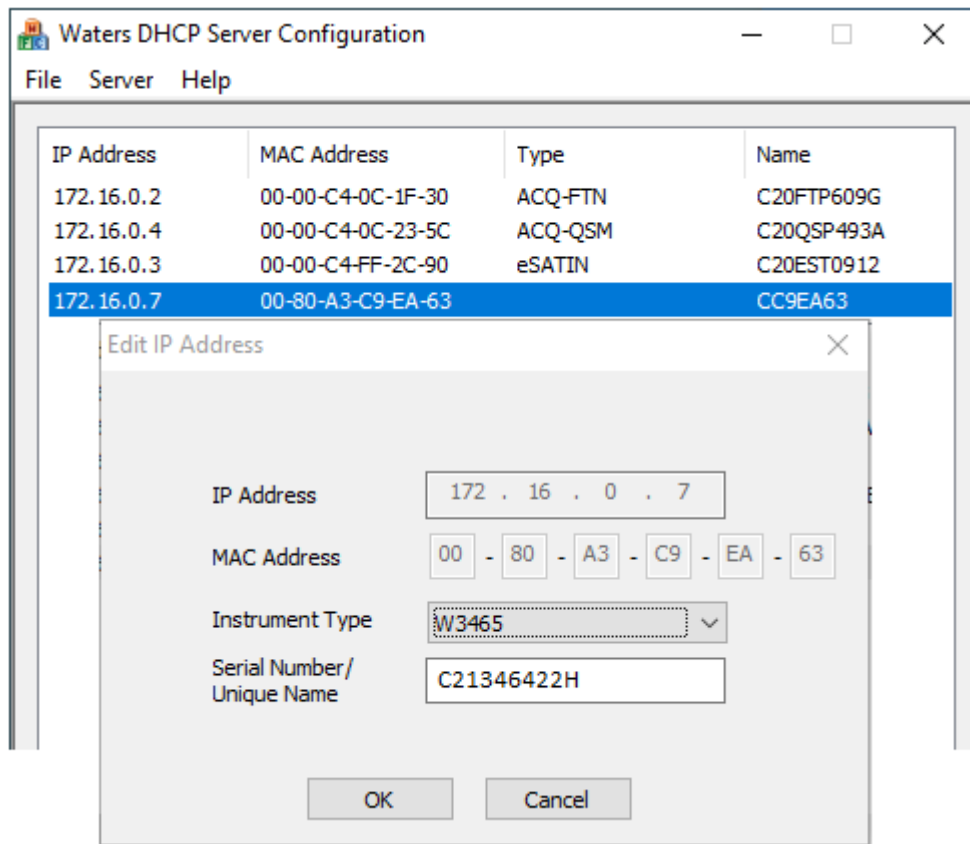
1. Start the Waters DHCP server, go to menu: Server/MAC address config
2. Enter 00 80 A3 and company name



3. Click OK to store the information.
4. Switch off/on the ECD, this resets the IP address of the ECD
5. Note that the address is now visible in the DHCP server. You may notice that the type is missing and the name is not correct.



6. Double click on the new device, and fill in the type “W3465” and serial number and store the information.
7. Continue with the next step (Agilent preConfigurator).

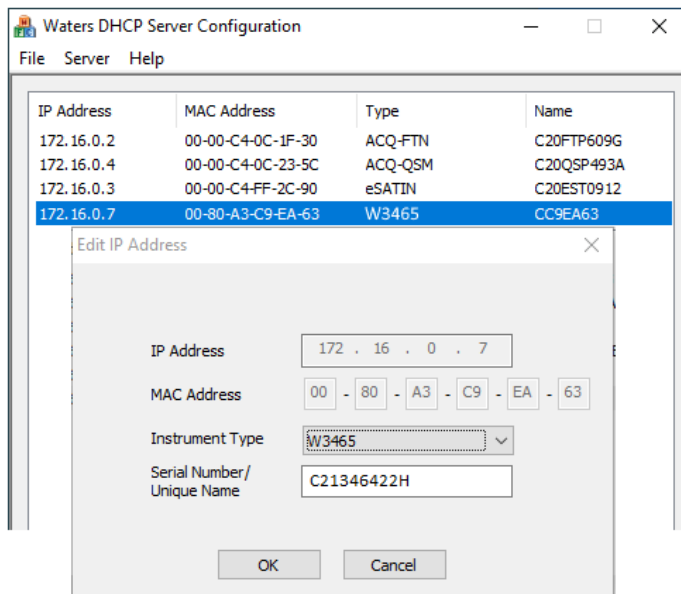


*In case of installation with version of ICFSL < 3.7, the driver must be installed as “AgilentLC” type device. The “W3465” device type is only working from ICFSL version 3.7 and newer.

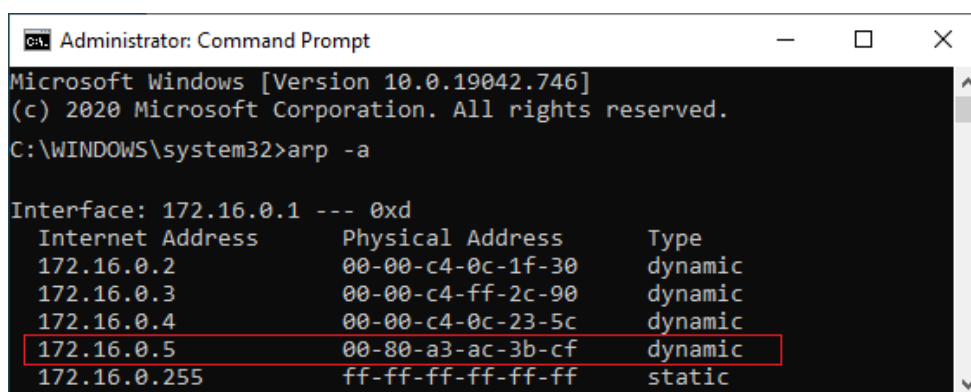
Waters DHCP Server Configuration – ECD with fixed IP

In case the Waters ECD is set with a fixed IP address, the information must be entered manually in the DHCP server configuration.

1. Note the Waters 3465 IP address and MAC address.
2. Start the Waters DHCP Server and enter the required information for the ECD.
3. The ECD driver is using the Agilent ICF support layer, it is type “W3465”.*)



In case the fixed IP address or MAC address is not available, start a tool to scan for connected devices to the PC. This can be done for example, by using the Windows Command Prompt “arp -a” command. This lists all connected network adapters and devices with the MAC address. Compare with/without the ECD connected. First, the ECD must be connected by LAN cable to the PC. Then switch on the ECD. **Switching on the ECD without first connecting the LAN cable will not work!**



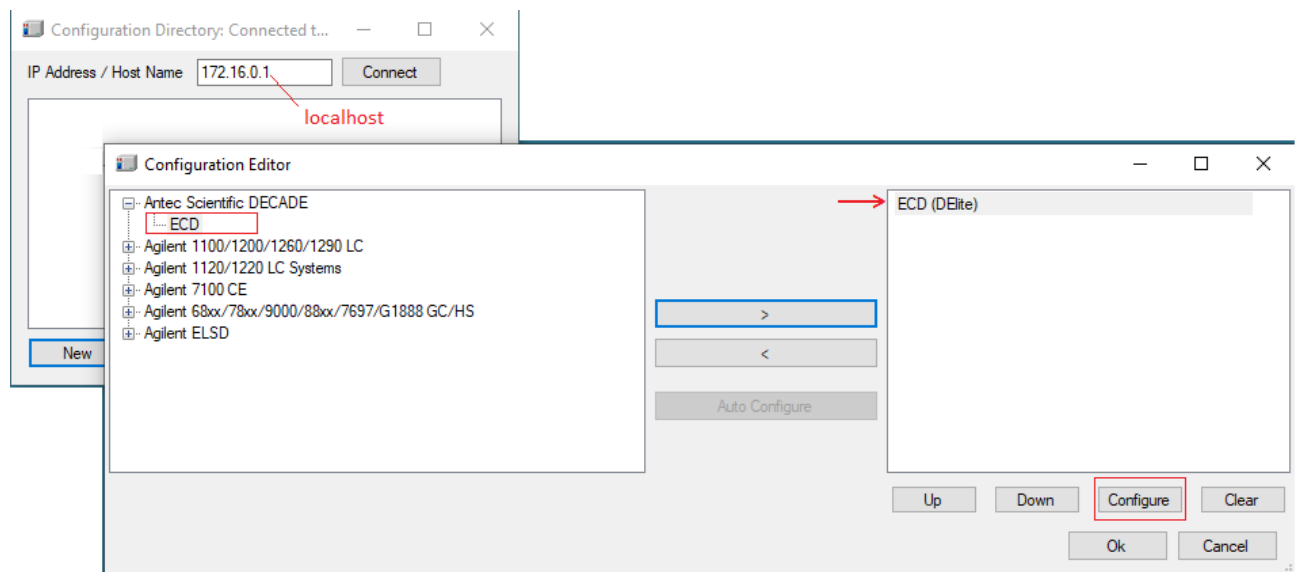
If the device is really ‘lost’ and IP not found, use the Antec “XPort” tool for deep scanning all network adapters and sub networks.

*) In case of installation with version of ICFSL < 3.7, the driver must be installed as “AgilentLC” type device. The “W3465” device type is only working from ICFSL version 3.7 and newer.

Agilent PreConfiguration tool

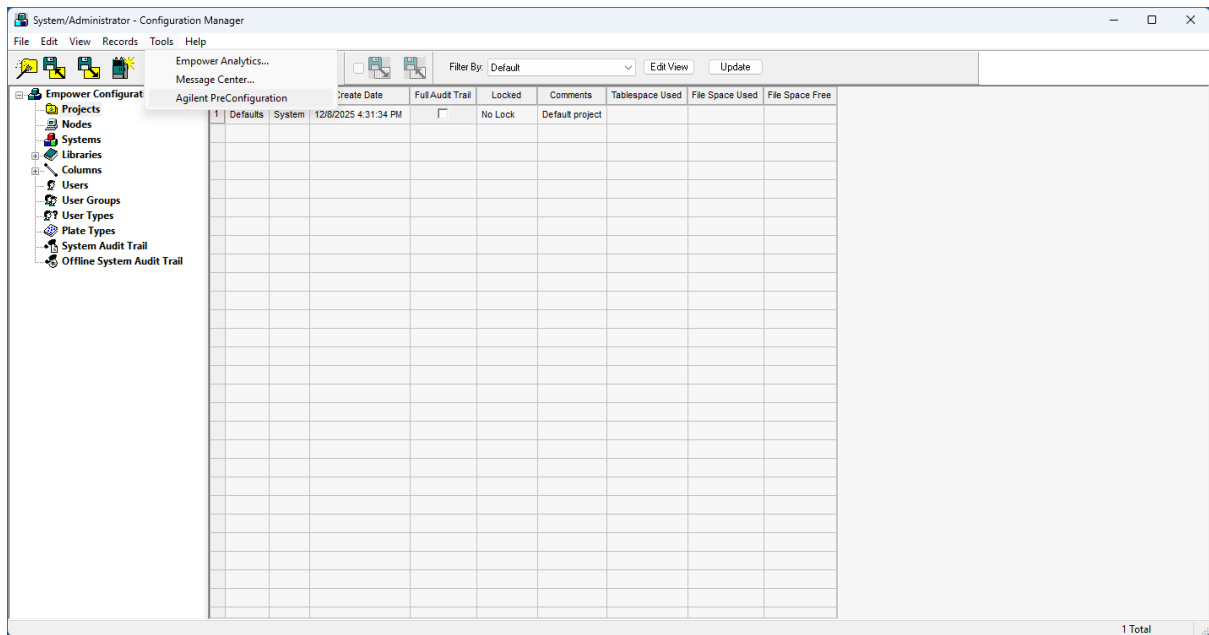
In this step the instrument configuration is set. It is usually done once, at installation. First we connect to the PC adapter, then add the ECD driver, fill in the ECD IP address and settings and save the configuration.

1. Start the Agilent PreConfiguration tool, fill in the IP address of the PC network adapter (do not fill in the ECD IP address here). Type “localhost” in case you don’t have the IP address at hand. Click connect button.
2. If the ECD is not shown already, click “add” and select the ECD from the left panel. Click the “>” button in the middle to add the ECD to the configuration (right panel).



3. Click the “Configure” button and proceed with the configuration parameters (next chapter).

Starting from ICFSL version 4.0, the Agilent PreConfiguration tool is integrated into the Configuration Manager in the Empower software. It is accessible by going to the menu Tools – Agilent PreConfiguration.



The screenshot shows the 'System/Administrator - Configuration Manager' window. The interface includes a menu bar (File, Edit, View, Records, Tools, Help), a toolbar with icons for Empower Analytics, Message Center, and Filter By (Default). Below the toolbar is a tree view on the left with categories: Empower Configuration, Projects, Nodes, Systems, Libraries, Columns, Users, User Groups, User Types, Plate Types, System Audit Trail, and Offline System Audit Trail. The main area displays a table with the following columns: ID, Name, System, Create Date, Full Audit Trail, Locked, Comments, Tablespace Used, File Space Used, and File Space Free. The table contains one row of data.

| ID | Name | System | Create Date | Full Audit Trail | Locked | Comments | Tablespace Used | File Space Used | File Space Free |
|----|----------|--------|----------------------|--------------------------|---------|-----------------|-----------------|-----------------|-----------------|
| 1 | Defaults | System | 12/8/2025 4:31:34 PM | <input type="checkbox"/> | No Lock | Default project | | | |

1 Total

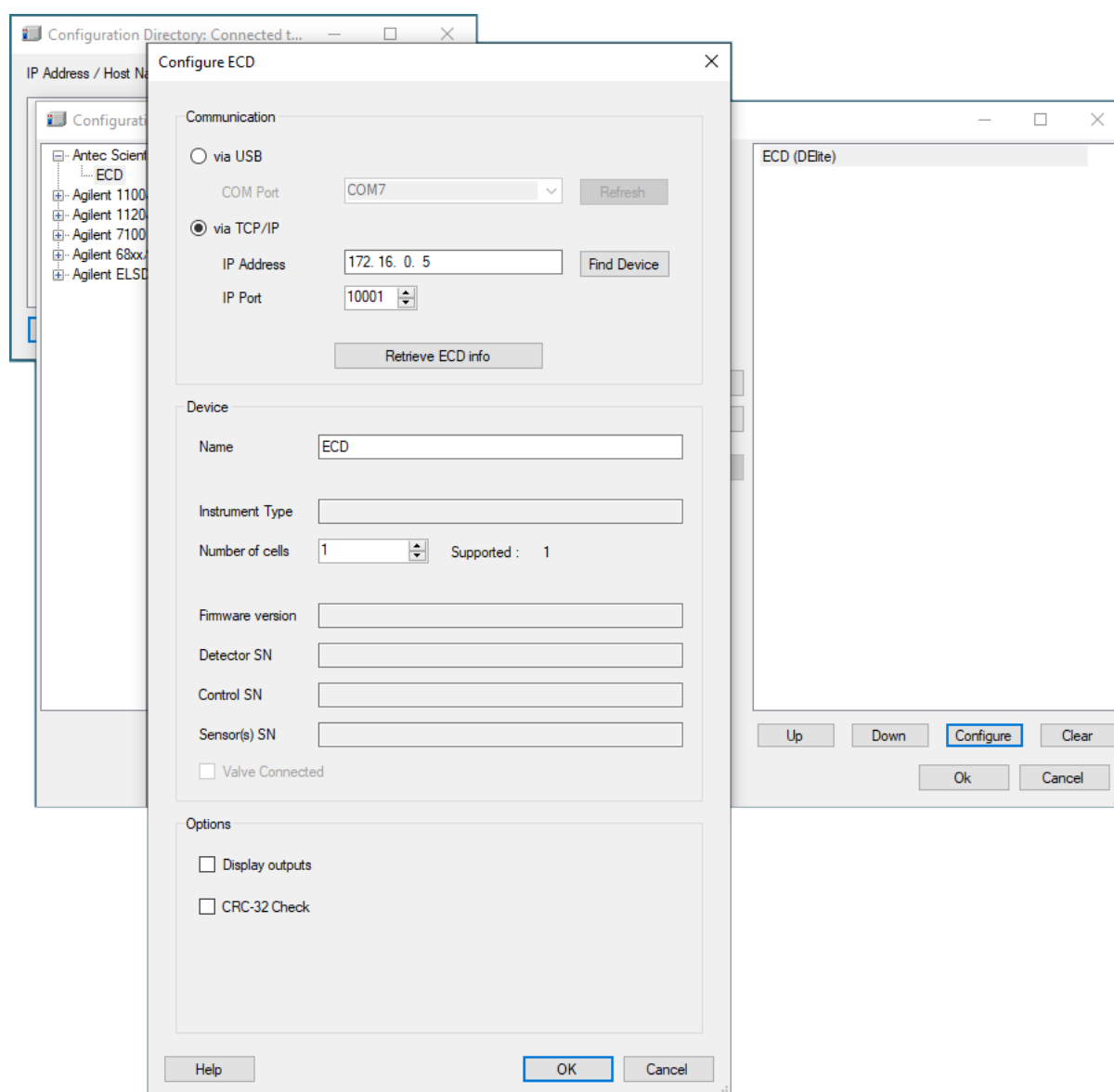
Note:

The driver has been developed and tested with one Waters 3465 ECD per Empower installation. Do not add more than one ECD, as unexpected behavior will occur.

4. Configuration parameters

When a module is added to the Agilent configuration, it needs to be configured before it can be saved. Click on the “configure” button to enter the configuration menu. The configuration menu has 3 sections:

- **Communication** : port or IP settings
- **Device** : device name, type and serial numbers, and extra valve
- **Options** : for display of outputs, and using a checksum on data



Communication

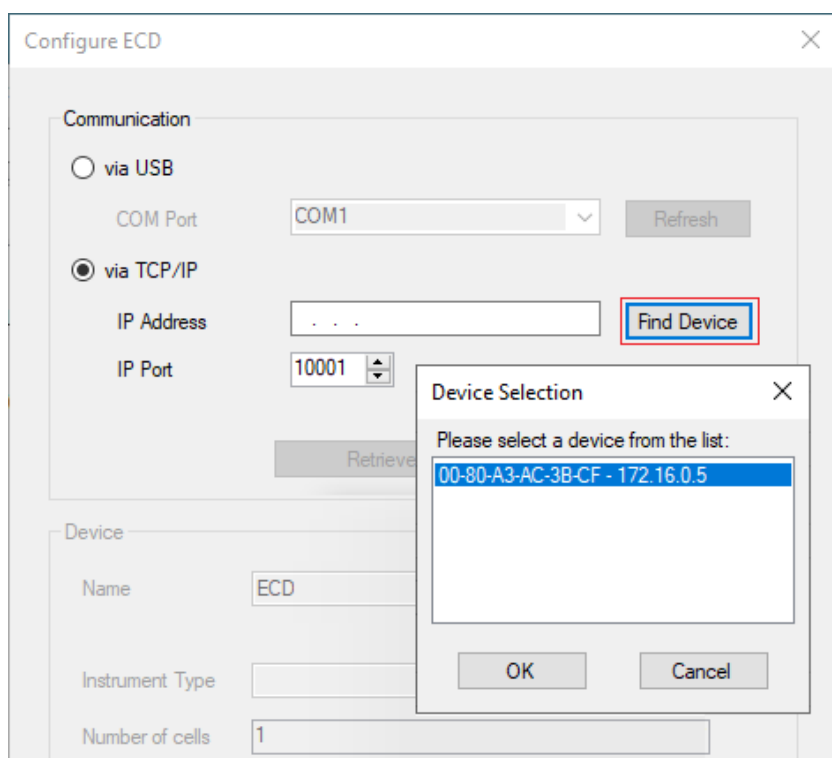
The ECD device communicates with a PC using USB or LAN. Switch on and connect the device to the PC, select the connection that is used, and set the port or IP address. For details see ECD device user manual (chapter "Installation").

USB: in case the device is connected via USB select the correct PC virtual serial port that is used. The device must be on and connected to the PC with the USB cable. The pull down menu shows the available COM ports. The virtual COM port of the device is usually visible in the list as soon as the device is on and connected. If not visible, a restart of the PC is required.

Note: the USB port can only be selected after the device has been added in the Agilent preConfigurator via TCP/IP.

TCP/IP: in case the device is connected via LAN enter the IP address of the device, or select the device from the 'find device' window. The LAN adapter of the PC must be in the same IP range. In the previous example the IP address of the PC is 172.16.0.1, and the device IP address is 172.16.0.5. For direct connection a special cross-over UTP cable is needed, for connection via a switch a regular network cable.

Find device: Click button to find devices on the network. First 10 characters is the MAC address, followed by the IP address. Only devices connected to the same LAN network with the same IP range are found.



IP Port : port number for LAN communication, is normally set to 10001.

Retrieve ECD info: to confirm a selected device, click "Retrieve ECD info". This will automatically fill in the "Device" fields. The "retrieve" is required, it is not possible to add a device that is not physically connected and available.

Device

This section is mostly information fields for serial number and other device information. The number of active cells can be set here in case of dual cell control. This would only make sense in case a dual cell device will be used with a single cell only for longer time. The 'valve connected' shows if an external valve is connected to the ECD device using the valve control cable at the rear panel.

Name: is device name, displayed in method.

Instrument type : ECD type.

Number of cells : select the number of cells (in case 'supported' cells > 1).

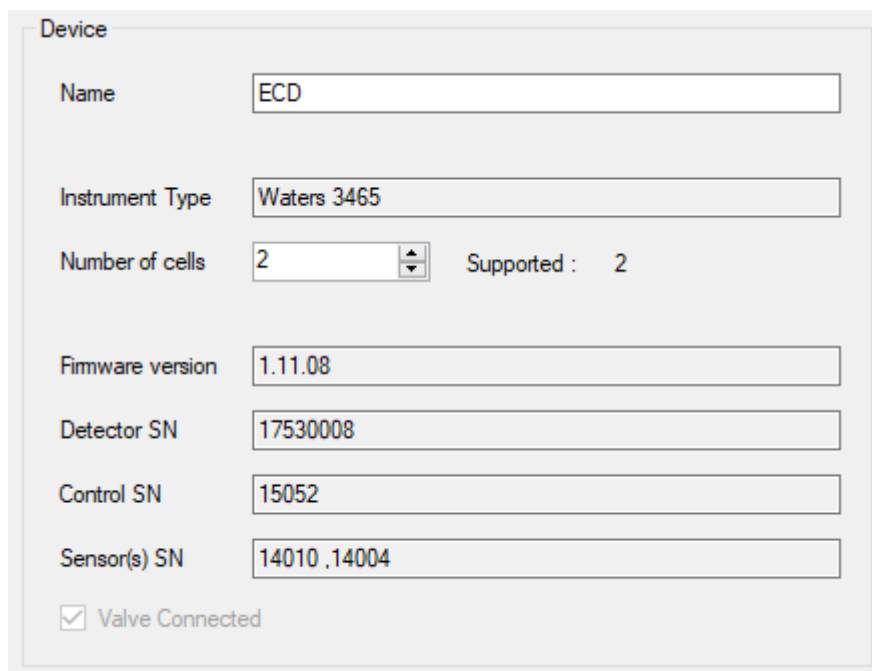
Firmware version : firmware revision number

Detector SN : serial number ECD device

Control SN : serial number ECD control board

Sensor(s) SN : serial number ECD sensor board

Valve connected : checked when external valve is connected to ECD device



The screenshot shows a configuration window titled "Device" with the following fields and values:

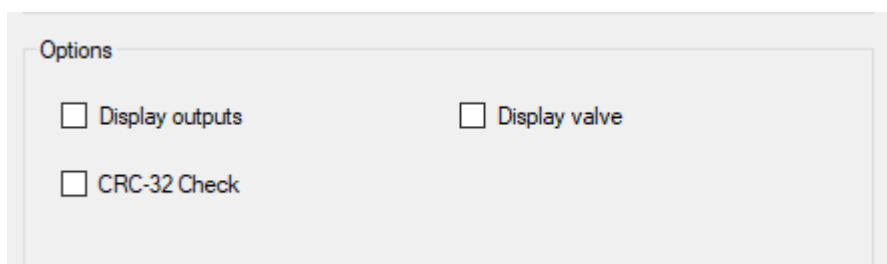
| | |
|------------------|-------------------------------------|
| Name | ECD |
| Instrument Type | Waters 3465 |
| Number of cells | 2 (Supported : 2) |
| Firmware version | 1.11.08 |
| Detector SN | 17530008 |
| Control SN | 15052 |
| Sensor(s) SN | 14010 ,14004 |
| Valve Connected | <input checked="" type="checkbox"/> |

Options

Certain options can be set with the configuration. **Display of the output** status only makes sense in case the output cable is used connected to the rear panel of the ECD. It can be used to control external devices. The data **checksum** is an additional data verification for data acquisition. It calculates and adds the 32-bit checksum over each data transmission, which is verified by the receiving software and accepted only when the checksum is identical. Otherwise the data is re-queried. For normal use this option is not really needed, as data transmission is already extremely safe by the nature of the data protocol.

Display outputs: display or hide the ECD output status in the method window

CRC-32 check: use a 32 bits checksum check for data acquisition transmissions (normally “off” when connected to TCP/IP).



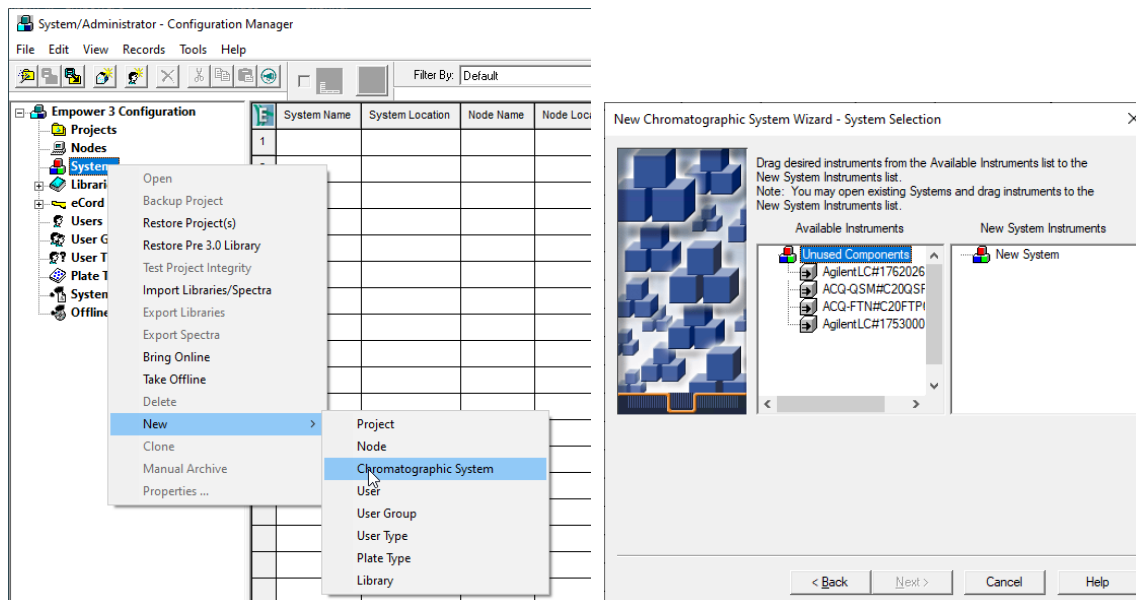
The image shows a screenshot of a software configuration window titled "Options". Inside the window, there are three checkboxes, all of which are currently unchecked. The first checkbox is labeled "Display outputs", the second is "Display valve", and the third is "CRC-32 Check".

5. System

In the previous two steps the ECD has been added to the Waters DHCP Server Configuration, and the ECD has been configured in the Agilent PreConfiguration tool. Now the HPLC system can be configured in the Configuration Manager.

Chromatographic System

1. From the Empower main menu, click 'Configure the System'. The configuration manager opens.
2. From the left panel right click on 'Systems', select 'New', 'Chromatographic System'.



3. Add the instruments one by one from the left panel to the right. The ECD must be added last in the list in the right panel.
4. When devices are added, finish the wizard and bring the system online (right click 'bring online').
5. Configure everything necessary, such as projects, eCord etc. When done, close the configuration manager.

The Instrument Method menu contains the sections:

Cells with the cell specific parameters:

Cell selection : selected cell to which the displayed parameters refer to. Is always 1 for a single cell configuration.

The 3 tabulated sections:

- **Main**: ECD parameters related to device status
- **Output**: ECD output parameters related to data acquisition
- **Time Table**: parameters that change during analysis time

The screenshot displays the configuration interface for an ECD (725000673). The interface is organized into several sections:

- Instrument Method**: Includes tabs for Pretreatment Method, Auxiliary Channels, General, and Instrument Configuration.
- ECD (ICD)**: The main configuration area.
- Cells**: A dropdown menu for Cell selection, currently set to Cell 1.
- Main**: A tabbed section (highlighted with a red box) containing:
 - Compensation On
 - Range: 100 μ A
 - Offset: 20 %
 - Filter: 0.2 Hz
 - Polarity: +, -
- Aux/relays**:
 - Relays: 1, 2
 - TTL contact: 1, 2, 3, 4
- Valve position**: Load, Inject
- Oven**:
 - On
 - Temperature: 35 $^{\circ}$ C
- Temperature control**:
 - Off
 - Difference: 1.0 $^{\circ}$ C
 - Duration: 1.00 min
- Stoptime**: 1.00 min
- Posttime**:
 - Off
 - 1.00 min

Global device parameters

The global device parameters are not cell or mode specific, they apply to the device and are not automatically changed when changing a cell or mode.

Oven: set the temperature of the ECD cell compartment. This parameter is independent from selected cell (so called global parameter).

Temperature control: defines the parameters for ECD device "ready" status, when the oven is stabilizing. When selected, the ECD device will be ready when within the **temperature difference** window for a **minimum duration**. The temperature difference window should be chosen with care. A window of ≥ 1.0 °C is advisable, a smaller T window may lead to unacceptable long waiting time when starting a run.

Stoptime: analysis time for data acquisition. The Stoptime must be the same as 'RunTime' in the samples table.

Posttime: duration before system is 'ready' after finishing the analysis. Is sometimes used to create a delay between runs in a sequence.

| | |
|---|--|
| <p>Oven</p> <p><input checked="" type="checkbox"/> On</p> <p>Temperature <input type="text" value="35"/> °C</p> | <p>Temperature control</p> <p><input type="radio"/> Off</p> <p><input checked="" type="radio"/> Difference <input type="text" value="1.0"/> °C</p> <p>Duration <input type="text" value="1.00"/> min</p> |
| <p>Stoptime</p> <p><input type="text" value="1.00"/> min</p> | <p>Posttime</p> <p><input checked="" type="radio"/> Off</p> <p><input type="radio"/> <input type="text" value="1.00"/> min</p> |

Important notes:

1. A temperature difference window of ≥ 1.0 °C must be set to avoid unacceptable long waiting time.
2. Set the temperature well above the device self-heating temperature (temperature with oven set off). If the temperature is too close to self-heating, the sequence may stall and wait for temperature to get in specified range.
3. The **Stoptime** must be the same as **RunTime** in the samples table, to avoid unexpected behavior or stalling a sequence.

Main

Cell on: switches on or off the flow cell. When unchecked (off), the ECD is 'not ready' for analysis.

Autozero at start: check option to apply an automatic autozero after start of run, but prior to the start of acquisition. The autozero is executed during the autosampler sample processing time. This only makes sense if 'Compensation' is on in the 'Output' menu. Otherwise the autozero will be undone at the start of the run.

Mode: set the ECD detection mode to

- **DC:** constant potential measurement
- **Pulse:** measurement with multiple potential steps
- **Pulse Type 2:** measurement mode applies interpolated potential coordinates

Each mode has different 'Sensor' parameters.

DC

DC is a measurement mode with constant potential applied.

Rate: data acquisition rate in data points per second. Parameter is dependent on the filter setting, except when filter is set to 'raw'. In that case the data rate is selectable between 1 and 100 Hz.

E Cell : working potential for the ECD cell.

The screenshot shows a software interface for configuring an ECD cell. At the top, there is a 'Cells' section with a 'Cell selection' dropdown menu set to 'Cell 1'. Below this are three tabs: 'Main', 'Output', and 'Time Table', with 'Main' being the active tab. In the 'Main' tab, there are two checkboxes: 'Cell On' (checked) and 'Autozero at start' (unchecked). Below the checkboxes is a 'Mode' dropdown menu set to 'DC'. Underneath the 'Mode' dropdown is a 'Sensor' section containing two controls: a 'Rate' dropdown menu set to '10' Hz and an 'E Cell' input field set to '0.80' V.

Pulse

Pulse is a measurement mode with multiple potential steps applied.

Autozero at start: check option to apply an automatic autozero after start of run, but prior to the start of acquisition. The autozero is executed during the autosampler sample processing time.

Rate: data acquisition rate in points per second, equal to $1 / [\text{total pulse duration}]$. In Pulse mode the filter setting has no effect on the rate.

E1 - E5: potential steps of the working electrode.

t1 - t5: duration of each potential step.

ts: duration of sampling time at the end of the first potential step.

The screenshot displays the configuration window for the Pulse mode. It is organized into several sections:

- Cells:** A dropdown menu for "Cell selection" is set to "Cell 1".
- Main:** Contains two checked checkboxes: "Cell On" and "Autozero at start".
- Mode:** A dropdown menu is set to "Pulse", and there is an unchecked checkbox for "Type 2".
- Sensor:** This section contains the following parameters:
 - Rate: 2.00 Hz
 - E1: 0.10 V
 - E2: -2.00 V
 - E3: 0.60 V
 - E4: -0.10 V
 - E5: 0.00 V
 - t1: 0.40 s
 - t2: 0.02 s
 - t3: 0.01 s
 - t4: 0.07 s
 - t5: 0.00 s
 - ts: 100 ms

Pulse type 2

Pulse (type 2) is a measurement mode which applies a potential coordinates table. The applied potential fluently interpolates between coordinates.

Autozero at start: check option to apply an automatic autozero after start of run, but prior to the start of acquisition. The autozero is executed during the autosampler sample processing time.

Rate: data acquisition rate in points per second, equal to $1 / [\text{total duration}]$. In Pulse type 2 mode the filter setting has no effect on the rate.

t and E: enter the potential coordinates in ms and mV. Minimum step is 10 (ms or mV). Always start with $t = 0$ [ms]. Each time can only occur once. Maximum table length is 30 rows.

Data: begin and end of interval of data sampling. Always include one 'Begin' followed by one 'End' at a later time.

Copy to clipboard/Paste from clipboard : the coordinates table can be copied from/to via right mouse click.

Graph: next to the table a graph shows the wave form. In red the sampling interval is shown.

Cells

Cell selection

Main | Output | Time Table

Cell On Autozero at start

Mode

Type 2

Sensor

Rate 1.67 Hz

| # | t (ms) | E (mV) | Data |
|---|--------|--------|-------|
| 1 | 0 | -200 | |
| 2 | 40 | -200 | |
| 3 | 50 | 0 | |
| 4 | 210 | 0 | Begin |
| 5 | 220 | 220 | |
| 6 | 460 | 220 | End |
| 7 | 470 | 0 | |

Output

Compensation On: enable or undo autozero compensation. Advised to use icw 'Autozero at start' from the Main menu.

Range: sensitivity setting of the measurement. Typically, the range is set to a value of 3 to 10 times the expected highest peak of relevance. This is particularly relevant for high sensitivity measurements. Range of 5 nA and below is for high sensitivity and small signals (available in DC mode only). Range of 10 nA and higher is for large peaks and high background signal.

Offset: applies an offset level to the measurement signal. For example, a full scale range setting of 20 nA and an offset of -10% sets the baseline after autozero to -2 nA instead of the usual 0 nA. Offset does not affect the uncompensated current, only the data for data acquisition.

Filter: applies an advanced digital filter to the acquisition data. The smaller the value, the stronger the filter setting. Only in DC mode, the filter also affects the data rate.

Polarity : reverses the data polarity, peaks that are negative become positive peaks (and visa versa). Polarity does not affect the uncompensated current, only the data for data acquisition.

Cells

Cell selection

Main Output Time Table

Compensation On

Range

Offset %

Filter Hz

Polarity

+

-

Time Table

Programmable parameters in the Time Table are: range, filter, offset, Ecell (DC only), autozero, and the TTL outputs 1 - 4, and the relays 1 and 2. The TTL outputs and relay require the IO cable connections for proper function. To be effective in the next analysis the TTL and relay must be set back to default after being activated.

Time Table : holds the programmable parameters that are executed during run time of the analysis.

Add: adds a new line to the time table.

Remove: removes the selected line from the time table.

Clear All: resets to an empty time table.

Cells

Cell selection

Main | Output | Time Table

Time Table (3 entries)

| # | Time [s] | Action | Action Value |
|-----|----------|---------------------|--------------|
| ▶ 1 | 10 | Sensor autozero | |
| 2 | 300 | Sensor output aux 1 | Active |
| 3 | 310 | Sensor output aux 1 | Inactive |

7. Status

Status menu in the CDS is accessible after 'Launch' of the instrument with the ECD. It reflects the relevant device parameters actual status.

- Uncompensated current
- Temperature
- Status parameters

The screenshot displays the 'ECD' status dashboard. At the top left, the title 'ECD' is shown above a green bar with the word 'Idle'. Below this, a table lists the status of two cells:

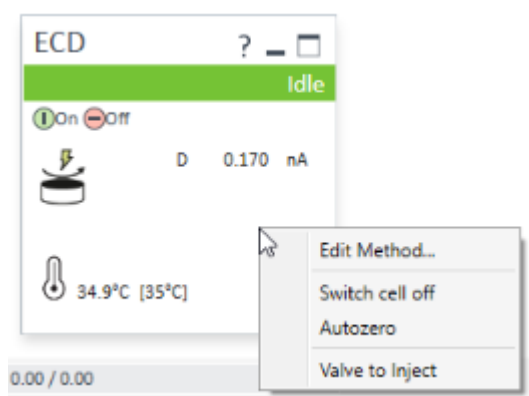
| Cell | Unit | Value | Unit |
|--------|------|--------|------|
| Cell 1 | D | 14.510 | nA |
| Cell 2 | D | 0.250 | nA |

Below the table, a temperature icon indicates a reading of 34.9°C [35°C]. At the bottom left, a progress indicator shows '0.00 / 0.00'. At the bottom right, the status 'Instrument Idle' is displayed with an information icon, a green 'On' indicator, and a red 'Off' indicator. The dashboard is framed by a 'Status Dashboard' and 'Collect Support Info' sidebar on the right, and navigation buttons for 'Instrument Status', 'Module Options', and 'Diagnostics Log' at the bottom.

Status and uncompensated current

Uncompensated current: upper part of the status window shows the real current value (I-cell) which is not affected by autozero, offset or polarity setting. The current value is preceded by D, P, or I for DC mode, Pulse mode or Pulse type 2 mode. By clicking the right top of the status window just above 'Idle', the extended view becomes visible.

When hovering the mouse over the status window, the **on/off buttons** appear. This button can be used to switch off/on the device, which practically means switching off/on the cell. A pop-up menu appears when right clicking on the status window.



The **Edit method** allows for changes in the device settings while 'idle', for example to stabilize at a certain temperature or potential before starting a method. It is however not possible to save such settings from this menu. **Switch cell off/on** and **Autozero** are also for stabilization purposes prior to running samples. The **Valve to inject** is only available in case an additional valve is present controlled by the ECD. It is not related to the autosampler valve.

Pictograms



Cell is on (at least one of the cells is on in case of dual cell configuration).

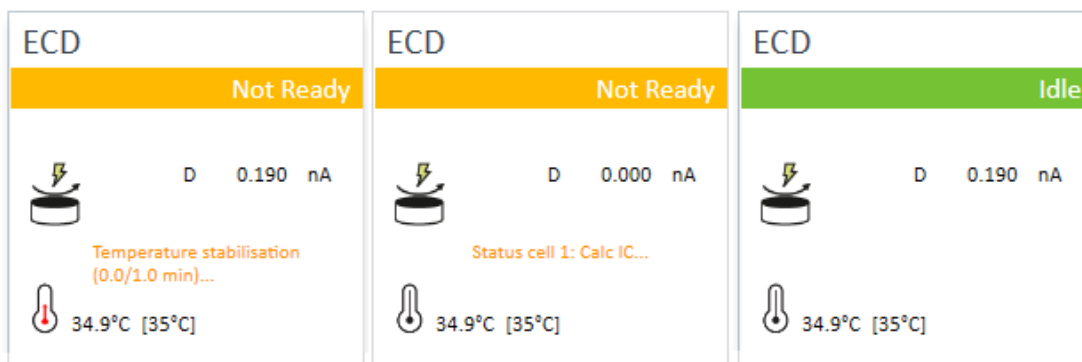


Cell(s) are all off.

Note: it is possible to start a run with cell off. For example, in a dual cell setup one cell can be deliberately set off when not needed. In that case the data for that cell will not be acquired. In case both cells are off no data will be acquired at all. After the run is finished the sequence will continue with the next run. Such condition may be desired when regenerating a column or switching solvents automatically.

Temperature

Temperature: real and [set] temperature. When stabilizing and 'temperature control' is set, the pictogram shows the stabilization status (left picture). The middle picture is most common when autozero has been applied. The picture on the right shows the idle (ready) status.



For example:

The is ECD heater is on and set to 30 °C. The actual temperature is stable at 30.2 °C.



30.2°C [30°C]

Pictograms:



temperature is on and stable.



temperature is off.



temperature is stabilizing.

Status parameters

Clicking the expand box in the top right corner of the status window shows a few more status parameters.

Data: processed data for acquisition (incl zero compensation, offset, polarity)

Mode: measurement mode

Potential : measurement potential (DC), or the first potential in the sampling interval (Pulse).

Temperature: the [set] and actual temperature

Outputs: displays a binary status string, from left to right Aux 1, 2, relays 1, 2, Aux 3, 4. A few examples:

00 00 00 01 aux 1 activated


00 00 10 10 aux 2, relays 2 activated


00 01 00 00 aux 3 activated

Valve: displays the status (load or inject) of the external valve if present.

ECD

Idle

 D 5.010 nA

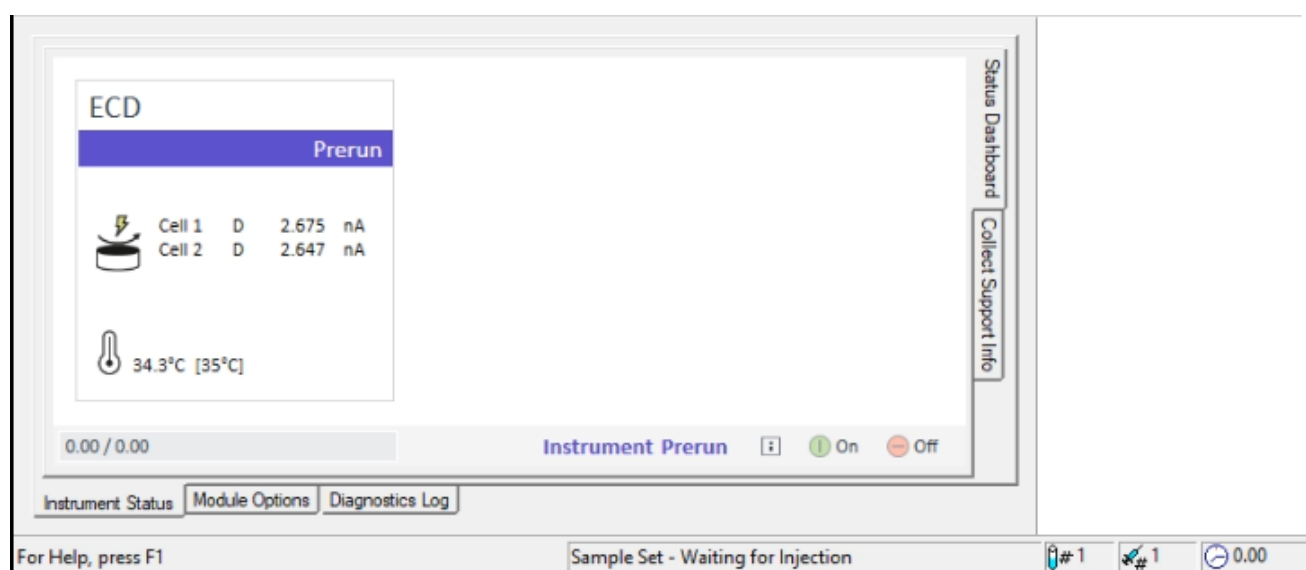
 34.9°C [35°C]

| | |
|-------------|------------|
| Data | -28.417 nA |
| Mode | DC |
| Potential | 0.50 V |
| Temperature | 34.9 °C |
| Outputs | 00000000 |
| Valve | Load |

External trigger

In most installations with Waters HPLC instruments, data acquisition is started at the moment the autosampler injects the sample. However, in exceptional cases an injector may be used that is not able to start the data acquisition. In such case, the data acquisition is triggered by an external trigger wire to the 'start' input of the 3465. Empower waits until the detector receives the injection signal from the injector before starting a run.

When a run or sequence starts, the connected devices will initialize and when ready go in the 'Pre-run' status waiting for a trigger. This 'waiting for injection' status is displayed at the bottom of the 'run samples' window.



Any external contact closure or TTL can trigger the 3465 start input. The start trigger wire usually comes from a relays of an injector, and are connected to pin 21 (start) and 25 (ground). When the external relays is closed, the start input is activated. The duration of the contact closure must be at least 0.2 sec, it is advised is to close the relays for a bit longer time. Before starting a next run, the contact closure must be released (opened) to be ready to apply a trigger again.

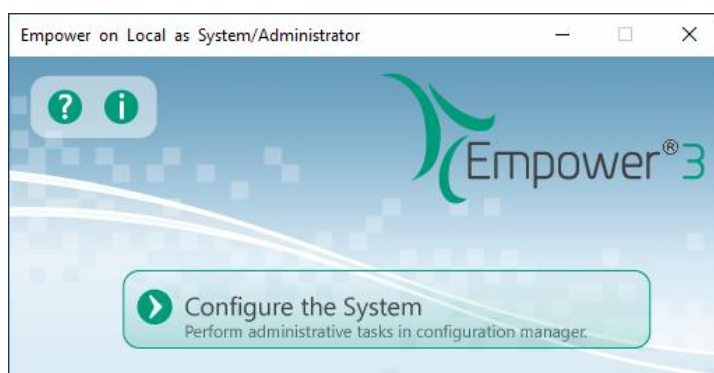
8. Custom fields

The measurement units of the Waters 3465 are in amperes, in nA to be exact. By default Empower reads the units in volts, as μV . An ECD signal of 1 (nA) is therefore displayed in Empower as 1,000,000 (μV). For convenience, it is possible to create a custom unit for peak height by multiplying by $1\text{E}-6$ and call the unit "nA". The custom area can also be created by multiplying $\mu\text{V.s}$ by $1\text{E}-6$ and have it in nA.s.

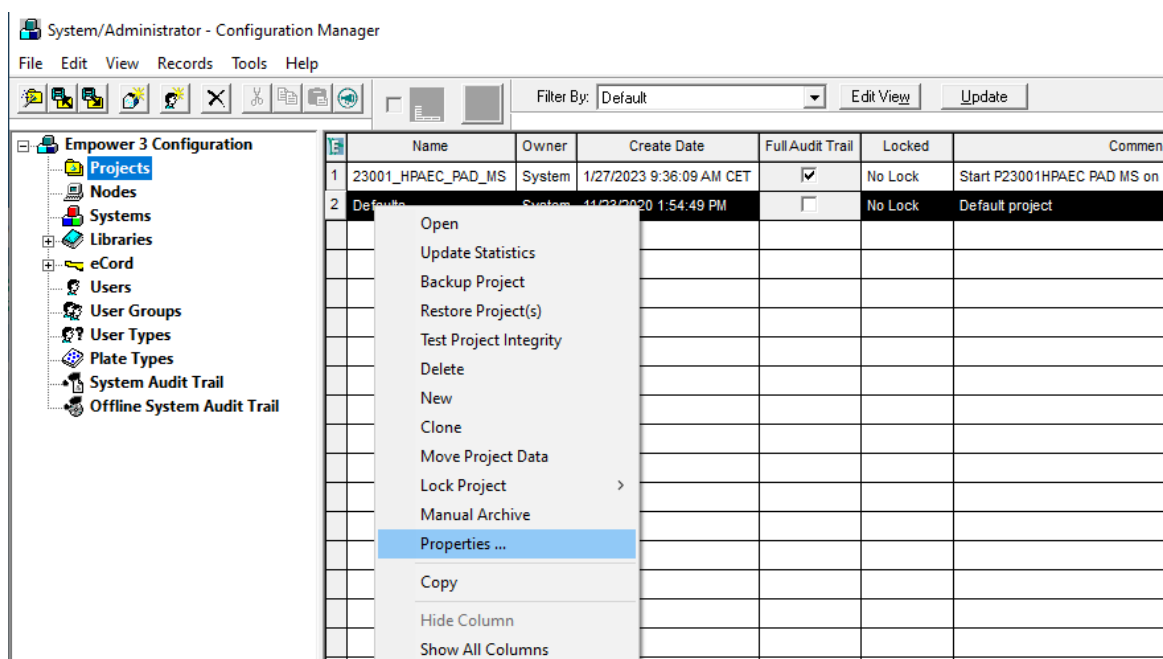
Create a custom field in Empower 3

To create a custom field in Empower, do the following:

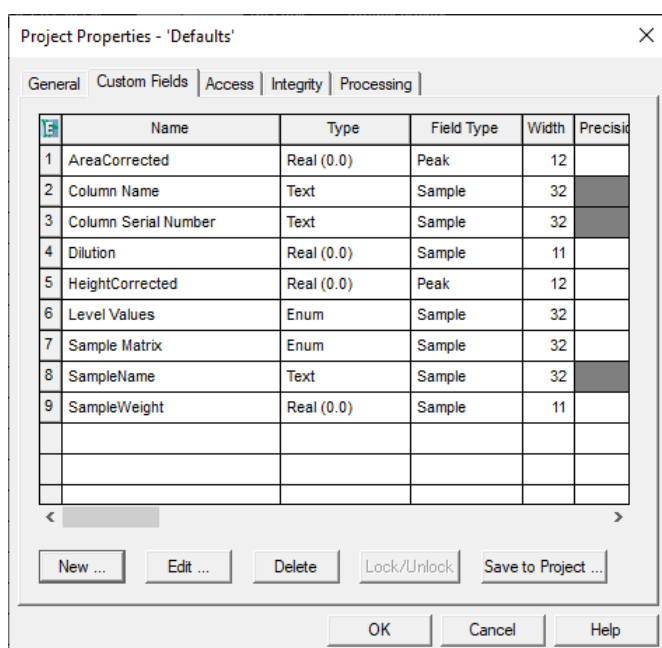
1. Go to system configuration manager



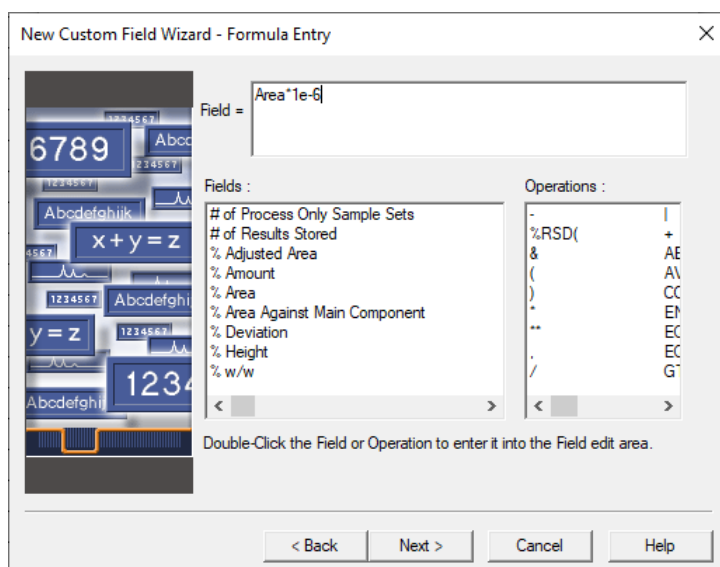
2. Go to the projects tab.
3. Highlight the project and right click on it, a dialog will appear, click properties.



- Go to tab 'Custom Fields' and click New ...

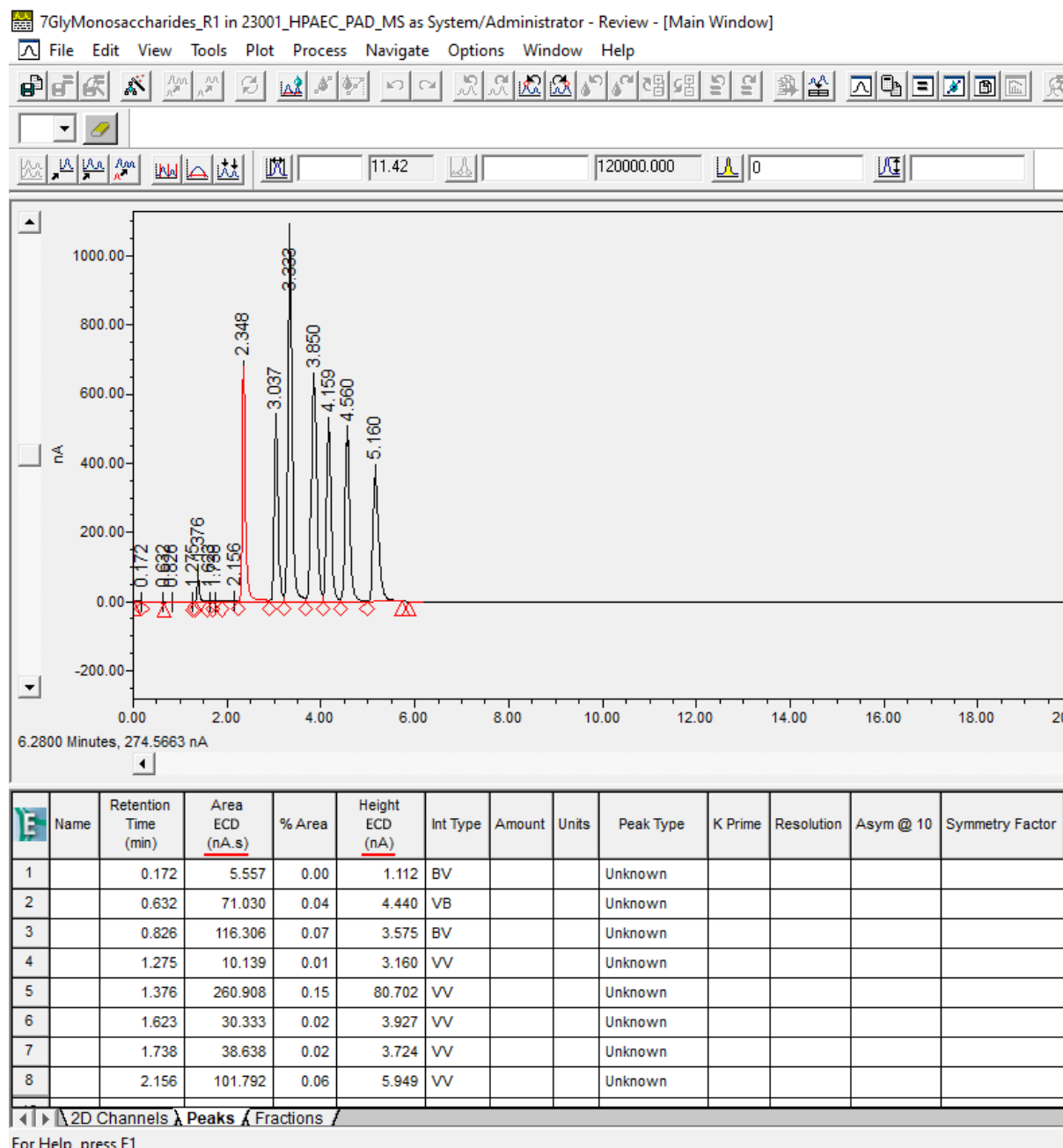


- New Custom Field Wizard will appear. Select 'Peak' as the field type, and 'Real (0.0)' as the data type. Click on Next >
- Select 'Calculated' as the data source and click Next >
- A formula entry window will appear. On the Field window, fill in $\text{Area} * 1e-6$ for Area ECD. Click on Next >



- Fill in the numeric parameters needed. In general, Width = 12, Precision = 3. Width is the number of character needed for the parameter, Precision is the character on the right of decimal point. Click on Next >

9. Fill in the Field name. In this case we fill in “Area ECD” as the unit for area. Click Finish when done.
10. Close the system configuration manager. Now the custom field is stored in the project and can be toggled on or off in table properties of the corresponding project.
11. Note that in case a minimum peak height or area is needed, the original parameter value must be entered (multiply nA or nA.s by 1E6).



9. Miscellaneous

Method compatibility

Only methods with identical configuration (same device type Elite/Lite, and same number of cells) are inter-exchangeable. Methods created on different configurations may lead to unexpected results, the advice is to create a new method.

Online help

To access Online Help, press the F1 key while the user interface is open within Empower CDS.

Driver Update

A driver update is provided as a full version and will not update your existing driver installation. The previous version must be completely removed from the computer before the new version can be installed. To update the drivers, please use the supplied instruction. It is highly recommended to create new instruments if the drivers have been updated. After updating it is advised, and often necessary, to restart the PC.

Uninstall the driver

The Waters 3465 ECD driver can be uninstalled from Microsoft control panel. You must be logged in with local administrator rights.

- 1 Open Microsoft Control Panel, and go to Programs and Features.
- 2 Select the Waters 3465 ECD driver from the list.
- 3 Select Uninstall and follow the wizard instructions.

Trouble shooting

In case the instrument cannot be configured or opened online, verify the following:

- 1 Double-check the communication settings as documented in this guide.
- 2 Double-check that all instruments are connected and turned on.
- 3 Check that the driver is correctly installed and reports the correct version.
- 4 Check the system configuration in terms of the maximum number of instruments allowed.
- 5 Run the Software Verification Tool.
- 6 Ensure that the firmware revision is correct for the specified instrument.

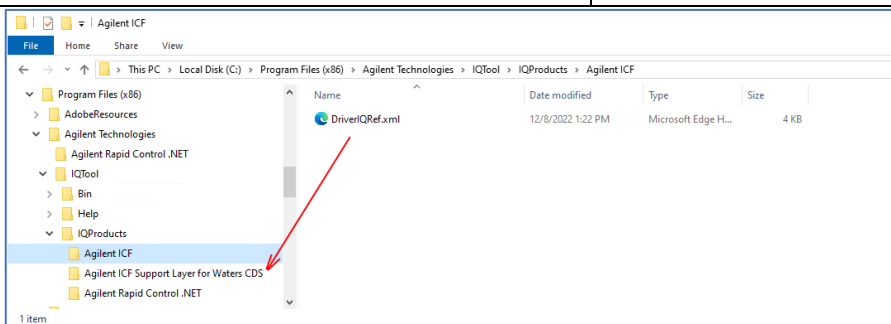
Support

Contact support@antecscientific.com for support on this device driver.

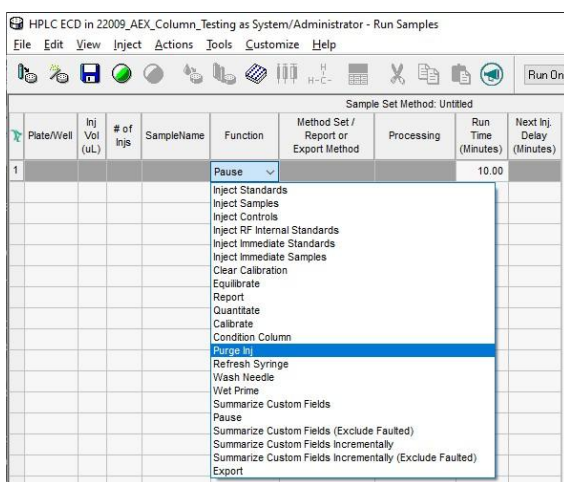
Known issues

| | Description | Workaround |
|----|---|---|
| 1 | Switching between Single Cell Configuration (SCC) and Dual Cell Configuration (DCC) cannot be done using a method created on a different cell setup. Unexpected behavior may occur. | Do not use SCC methods on a DCC setup or the other way around. To be sure the 2nd cell is not turned on in SCC mode when switched from DCC mode, reboot the ECD. |
| 2 | 'Post time' is the delay time between runs. Setting a Post time > 10 min results in an error message after the run. | Keep Post time < 10 min. |
| 3 | PC with insufficient resources may lead to data time out and stalling of a sequence. | See PC requirements for minimum requirements. |
| 4 | The integration table shows the data unit in V instead of nA. A multiplier of 1E6 has been applied to μV . | Create a 'custom field' in the Configuration Manager under Projects. Set the unit in nA and multiply the values by 1E-6. See Waters KB paper . |
| 5 | Run Time in 'Run Samples' and Stop time in 'Instrument Method Editor' are both needed. | Each method must be saved with the correct Stop time in the Instrument Method Editor. When changing time, it must be changed in both places. |
| 6 | Agilent -top level- device configuration cannot be edited once Empower has been started. An error message appears. Changing the device configuration can only be done while the device is offline. Once started, all devices in Empower are online. | Stop Empower, sign out from Windows (this stops services), login to Windows again. Do not start Empower. Start the Agilent configurator and apply and save changes. Always work with newly created methods when changing a configuration! |
| 7 | ECD -top level- device configuration is editable in the 'Instrument Configuration' tab in the Instrument Method Editor (Run samples window). When editing, it results in errors. | Do not use the 'Instrument Configuration' tab in the Instrument Method Editor. The ECD configuration cannot be changed while the device is online. |
| 8 | Instrument Method Editor window does not show up when I click 'Edit method'. When clicking again a message appears saying it is already open. | Method Edit window has no focus, often hidden behind Run samples window. Click in the taskbar on the Method editor icon. |
| 9 | After starting up a PC, login to Windows, and immediately starting Empower I get an error message 'Database Connection Failed !!' | After starting Windows, wait 5 min. It takes some time until the Oracle database is fully initialized. As an alternative, in Windows services restarting the 'OracleEmpowerOracle18cTNSListener' service helps. |
| 10 | Adding more than one Waters 3465 instruments to the Empower configuration does not work correctly. | Do not add more than one Waters 3465 instrument. |
| 11 | The Method Editor suddenly disappears (crashes) when saving settings more than once. When opened again, a message appears it is already open. | Each time when saving settings close the Method Editor. Open it when more edits are needed. |
| 12 | Connecting with USB port is not possible at first start. I get the message "could not determine the IP address from the configuration". | The procedure requires a few additional steps that are available from Antec support. |
| 13 | After installing an upgrade of the driver, the first time when starting Empower an error message occurs, mentioning a conflict such as command '7C' or '6E'. | After installing an upgrade, before starting Empower, it is often necessary to restart the PC. |
| 14 | After injection of a sample the detector remains in pre-run state and acquisition of the 3465 signal is not started | The Windows Defender firewall must be completely disabled in Windows. This service can cause communication problems with instruments and software. See Waters KB paper . |

| | | |
|----|---|--|
| 15 | After first installation of the driver, the 3465 ECD does not show up in the list of devices when creating a new system. | One possible cause is a setting in "region" in Windows. Under the "Administrative" tab, the "language for non-Unicode programs" should be "English". |
| 16 | Waters DHCP server configuration. In case of installation of ECD driver with version of ICFSL < 3.7, the driver must be installed as "AgilentLC" type device. The "W3465" device type is only working from ICFSL version 3.7 and newer. | Select device type "W3465" only with ICFSL 3.7 or newer. Older ICFSL versions, select type "AgilentLC". |
| 17 | The Agilent SVT (Software Verification Tool) report does not show the ECD driver when working with WICF 4.0 (successor of ICFSL). Solved in rev 1.3.5. | Copy the DriverIQRef.xml file from: C:\Program Files (x86)\Agilent Technologies\IQTool\IQProducts\Agilent ICF to: C:\Program Files (x86)\Agilent Technologies\IQTool\IQProducts\Agilent ICF Support Layer for Waters CDS |



| | | |
|----|---|---|
| 18 | Agilent SVT cannot continue verification for this product. Message "Duplicate add on id: 10501..." appears. | This happens when upgrading, and older reference files might be present. Uninstall both the ECD driver and WICF 4.0, reboot PC, then reinstall WICF and driver. |
| 19 | Non-inject functions without specified run time , such as wash needle or purge inj. cause instrument failure on the DECADE Elite as soon as the line is executed (right bottom status bar of Empower). | Do not use those functions. Non-inject functions with a specified run time , such as equilibrate or condition column, work correctly, ECD traces are stored. See screenshot below. |
| 20 | ECD potential settings in pulse mode in the report of Empower are in mV. This is incorrect, should be V. | See screenshot below. |



Screenshot of (non-)inject functions in Empower.

Potentials Table-IC0

| | Time (s) | Potential (mV) |
|---|----------|----------------|
| 1 | 0.4 | 0.05 |
| 2 | 0.2 | 0.75 |
| 3 | 0.4 | -0.15 |
| 4 | 0 | 0 |
| 5 | 0 | 0 |

Pulse mode potentials table in ECD report in Empower, showing the (wrong) unit in mV.

Known issues, only when using an external trigger to start the CDS

| | | |
|----|---|--|
| 21 | When using an external trigger for starting a run, a time-out error occurs if the CDS is waiting in 'pre-run' for more than 10 min. The run is aborted and the sequence stalls. | Apply an external trigger within 10 minutes after initializing 'pre-run' status (waiting for injection). |
| 22 | When using an external trigger on the 3465, and using a pump with gradient program, the program does not start with the run. Also, the run does not stop at the stop time. | The pump has to be external start triggered as well. Connect the wire trigger to the pump start input. Without starting the pump it will hold up the end of run until a time-out occurs. |
| 23 | Each time a run is started with external trigger, an error "Invalid run control sequence" appears in the message center. | This error is displayed in the message center in certain combination of devices. As it does not interfere with analysis, best is to ignore the message entry. |

In case an issue is encountered which is not listed in this section, please check the following knowledge base (KB) resources. The issue and remedy might be listed there:

Antec Scientific Knowledge base: <https://antecscientific.com/support/knowledge-base/>

Waters Knowledge Base: <https://support.waters.com/>

Or contact support@antecscientific.com in the case the KB's do not provide a remedy for your specific issue.