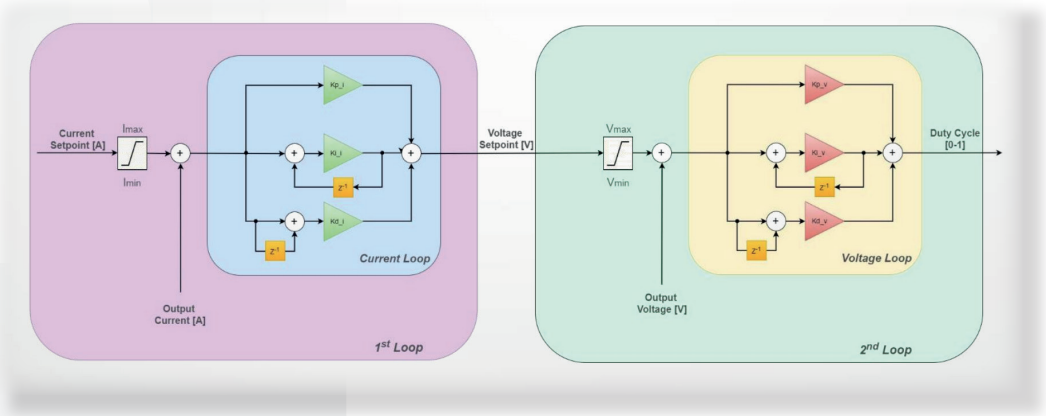
# PROCEDURE FOR ADAPTING THE PID PARAMETERS FOR THE Fast-Bi-1k5

## Pre-Information

All CAEN ELS power sources are digitally controlled. This means that an adaptation to any load can be achieved simply by changing the Software PID-Parameters.

Fast-Bi-1k5 power supply has a double control loop that continuously controls output voltage and current. Current Control Loop and Voltage Control Loop diagrams are hereafter presented:




**PID SETTINGS**

| Name | Value |
|---|---|
| PID Max Voltage | 21 |
| PID Min Voltage | -21 |
| PID Max Current | 101 |
| PID Min Current | -101 |
| PID V Kp | 0.0005 |
| PID V Ki | 0.0002 |
| PID V Kd | 0 |
| PID I Kp | 0.05 |
| PID I Ki | 3e-05 |
| PID I Kd | 0 |

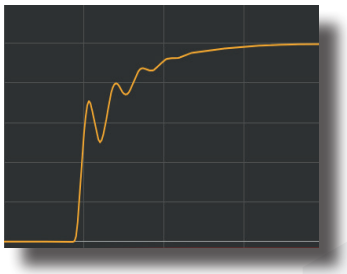
The PID-parameters consist in 6 values that can be input through the web-server interface: V Kp, V Ki, V Kd, I Kp, I Ki, and I Kd.

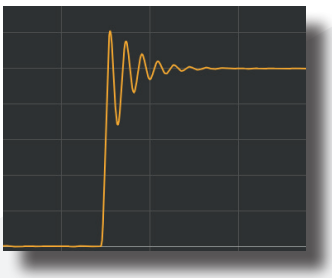
# PID PARAMETER ADAPTATION

## Target

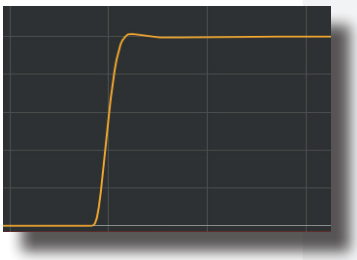
Target is to adapt PID values for a specific load connected to the Fast-Bi-1k5 power supply that is performing in an ideal way: Fast Rise Times, No Overshoot (or small Overshoot), No Oscillations.

**UNWANTED STEP RESPONSE:**





**DESIDERABLE STEP RESPONSE:**



## PID Adaption-Procedure

Due to safety concerns for both the source and the load, caused by potential dangerous high-frequency oscillations, the PID parameters should be set to very low values at the beginning of each adaptation for an unknown load.

To proceed follow these steps:

1. It is recommended to start with these parameters (safe side):

   **V Kp = V Ki = I Kp = I Ki = 0.00001 and V Kd = I Kd = 0**

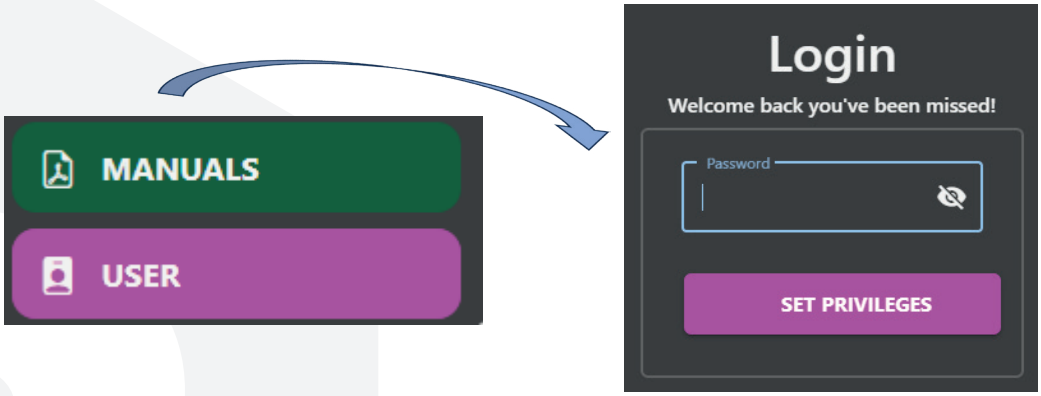
2. Kd typically should not to be changed due to its minor influence on the result. Only in very high-demanding cases, such as superconducting magnets, it might be adjusted.

3. During PID adaptation procedure, set current and voltage to approximately 10% of the nominal rating. (i.e. if the PS is a 20 A - 100 V model, set a Current and Voltage step from 0 to 2A/10V).

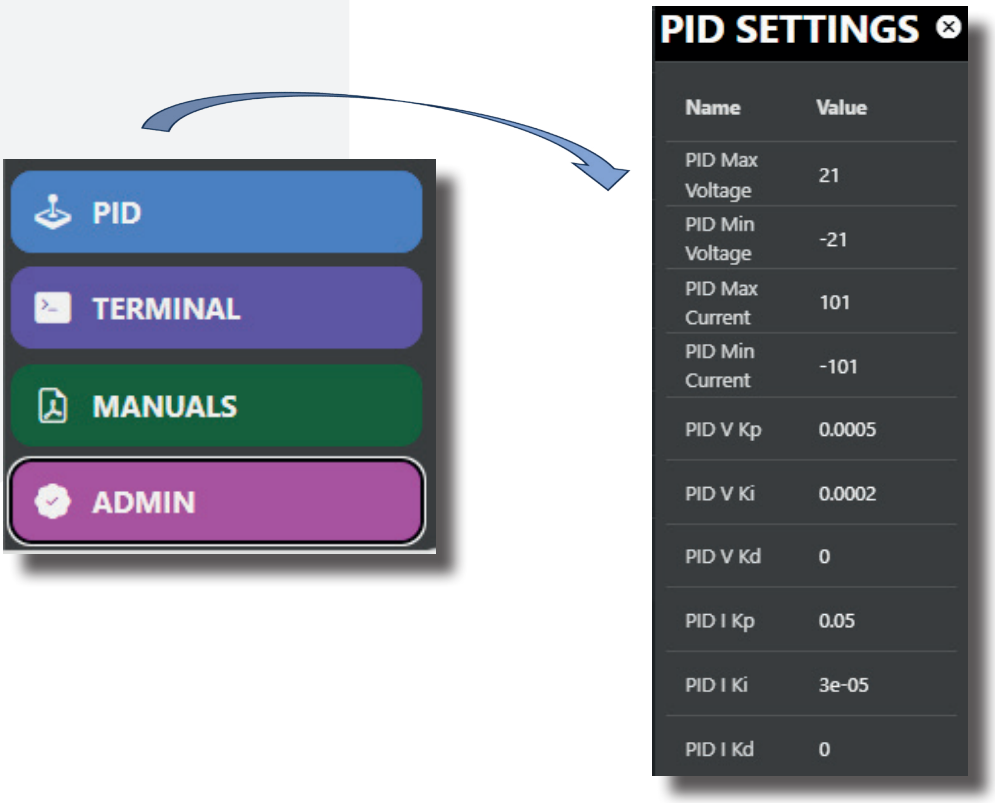
**ATTENTION**: The PID parameters are specific to each power source model. For example, PID parameters for a Fast-Bi-1k5 020100X and for a Fast-Bi-1k5 030050X can significantly differ.

Open the **GUI** from web server:

- Click on **USER** at the lower right side of the screen.
- Enter the password ( ps-admin) to log in with administrator privileges.

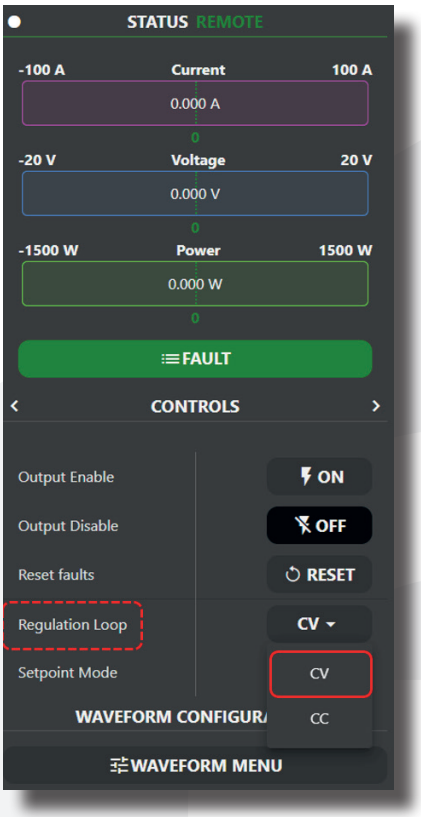


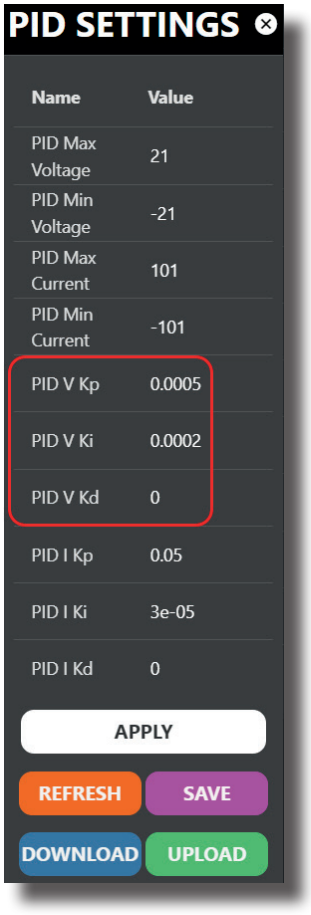

- Press **PID** button to access the **PID SETTING**.



From the main screen:

- In the drop-down **Regulation Loop** menu set **CV** (costant voltage).




### CV-Mode

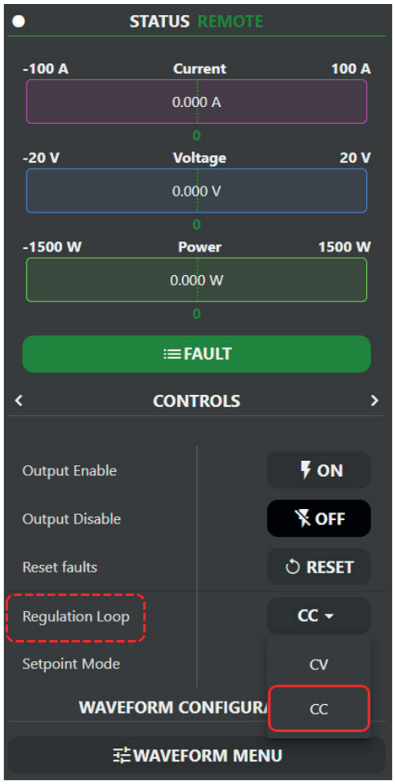
Following the **Voltage Control Loop Adaption** flowchart (see the next pages):

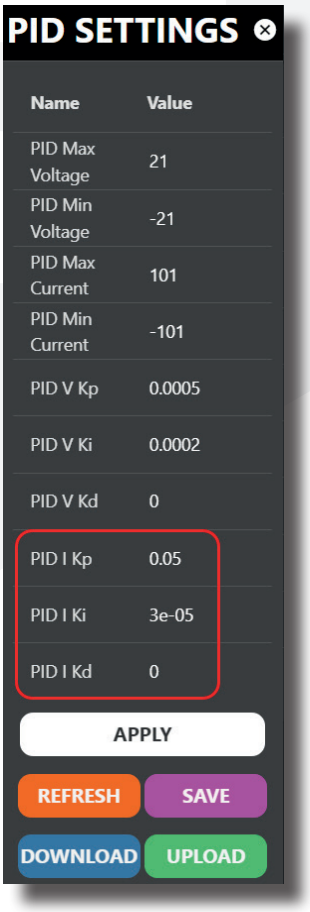
- Adapt the **V Kp** parameter.
- Adapt the **V Ki** parameter .

- For each parameter inserted, press **Enter**.
- Press **Apply** and **Save** to store the settings.

From the main screen:

- In the drop-down **Regulation Loop** menu set **CC** (costant current).




### CC-Mode

Following the **Current Control Loop Adaption** flowchart (see the next pages):

- Adapt the **I Kp** parameter.
- Adapt the **I Ki** parameter .

- For each parameter inserted, press **Enter**.
- Press **Apply** and **Save** to store the settings.

Voltage Control Loop Adaption

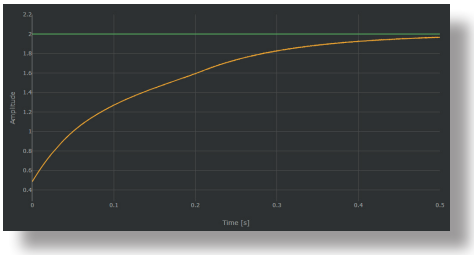


Fig. A

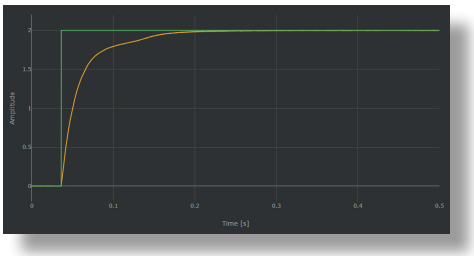


Fig. B

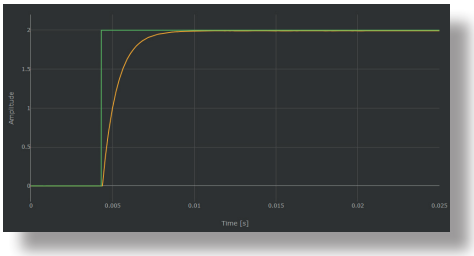
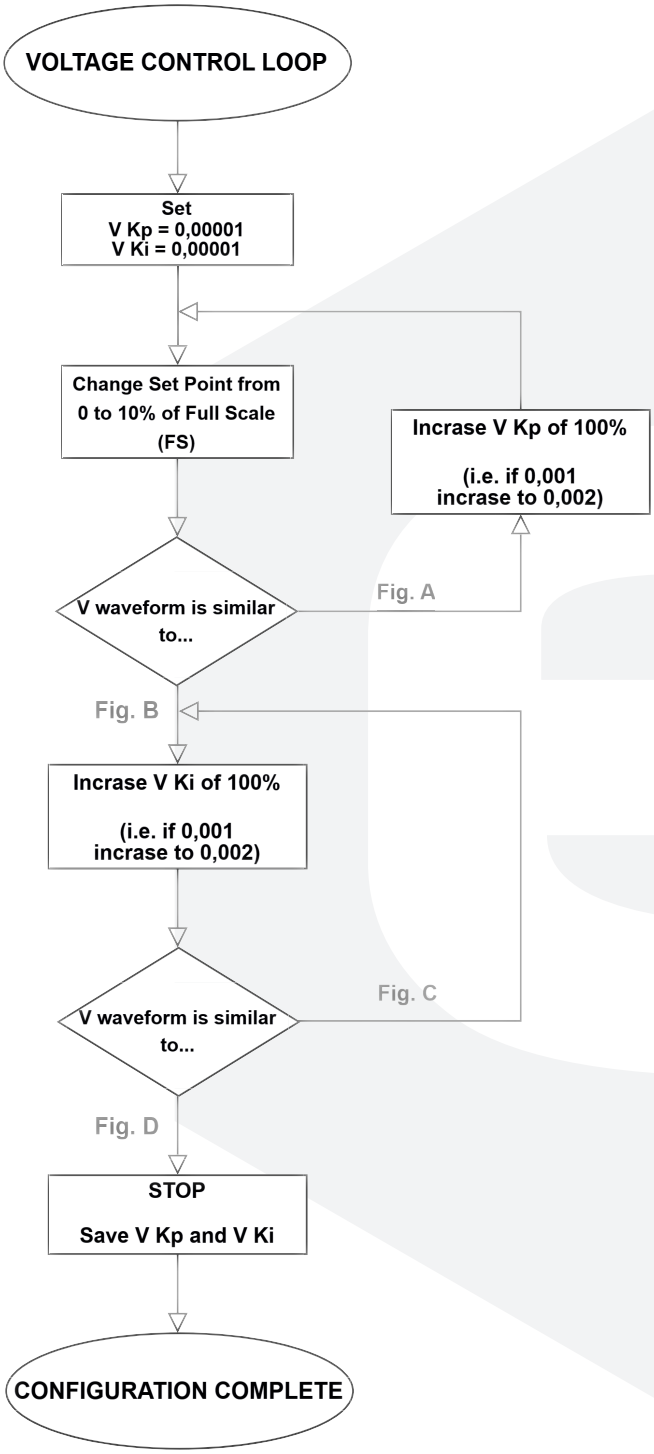


Fig. C

Fig. D




**NOTE**: In some cases when Fig.D is obtained, a further increase of Kp may reduce the voltage overshoot.

## Current Control Loop Adaption

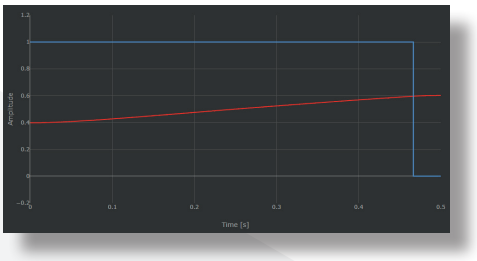


**Fig. A**

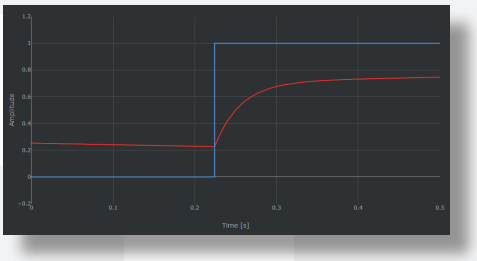


**Fig. B**

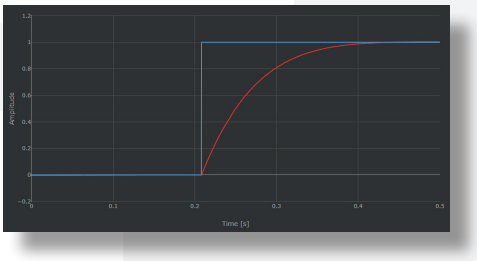


**Fig. C**

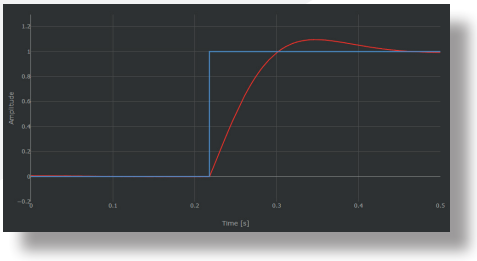
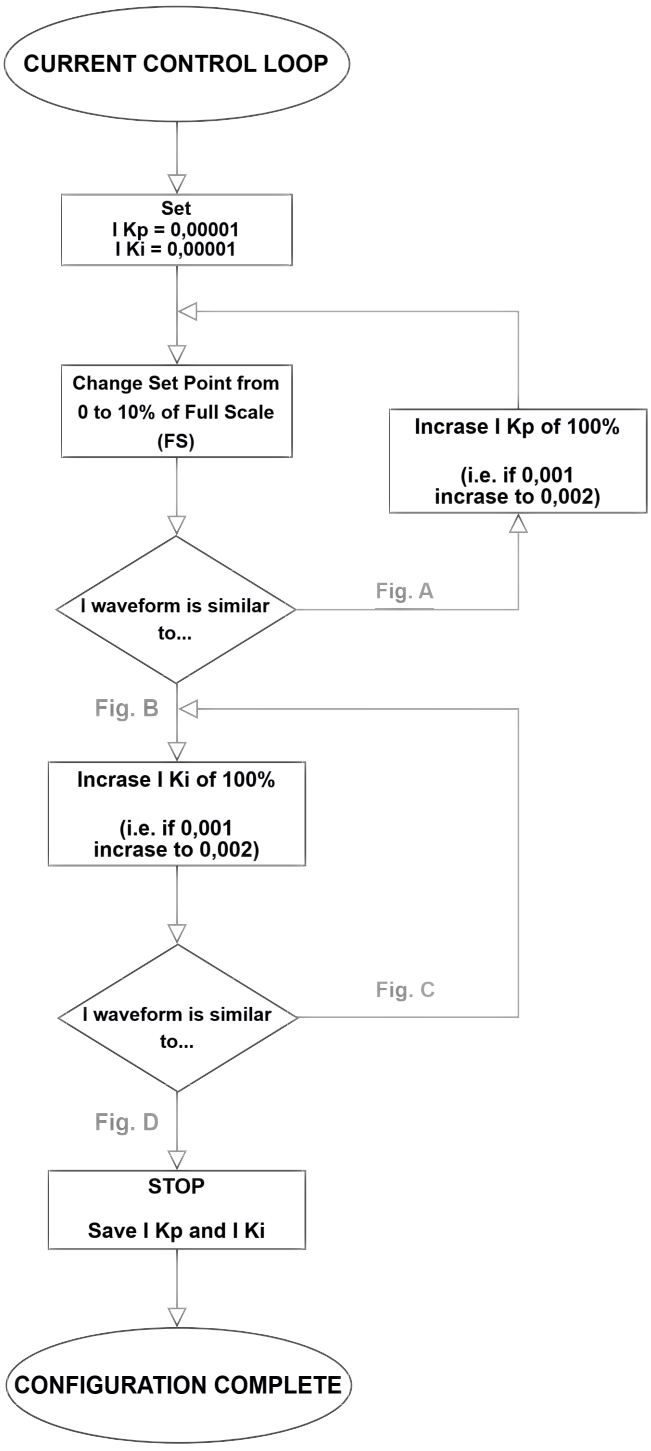


**Fig. D**




**NOTE**: In some cases when Fig.D is obtained, a further increase of Kp may reduce the current overshoot.

About Us

ELS Instruments (formerly CAEN ELS) is a leading company in the design of power supplies and state-of-the-art complete electronic systems for the Physics research world, having its main focus on dedicated solutions for the particle accelerator community and high-end industrial applications.

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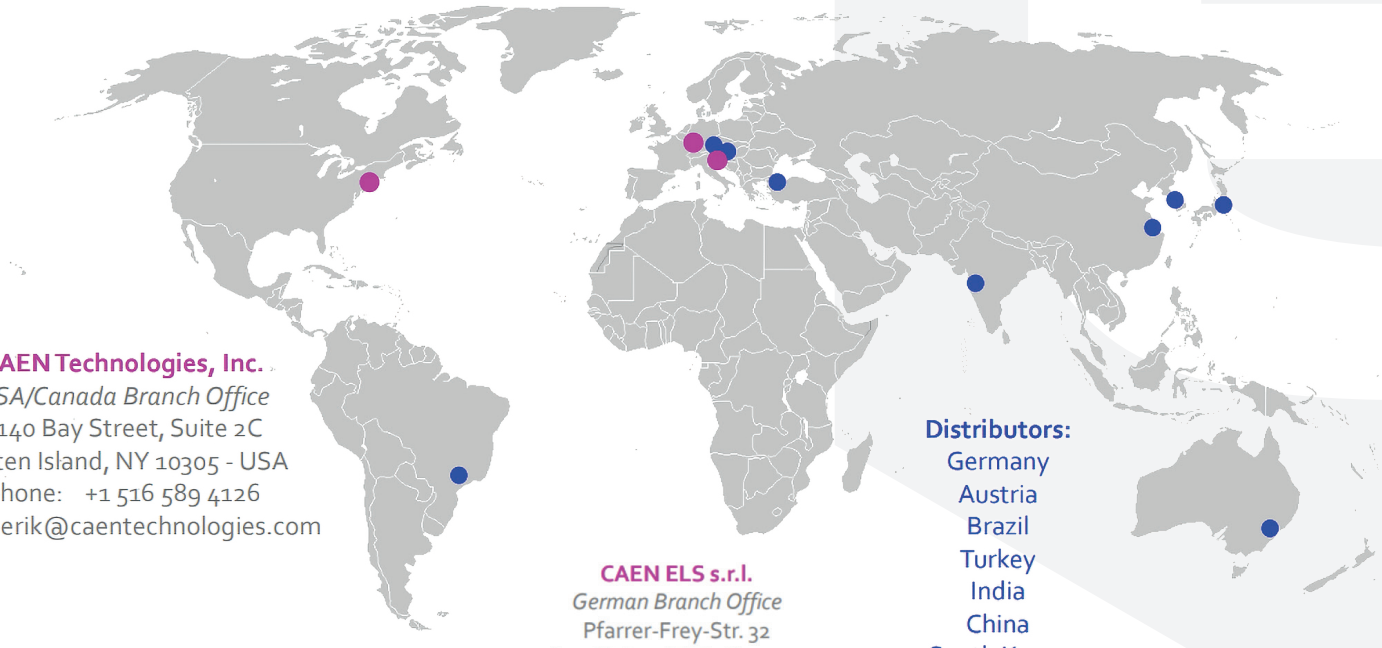
**ELS Instruments srl**
Via Karl Ludwig von Bruck 32
34144 - Trieste (TS) Italy

info@caenels.com
**www.els-instruments.com**
**www.caenels.com**



**CAEN Technologies, Inc.**
*USA/Canada Branch Office*
1140 Bay Street, Suite 2C
Staten Island, NY 10305 - USA
phone: +1 516 589 4126
mail: erik@caentechnologies.com

**CAEN ELS s.r.l.**
*German Branch Office*
Pfarrer-Frey-Str. 32
76770 Hatzenbühl - Germany
(near Karlsruhe)
phone: +49 1590 5238983
mail: **j.theiner@caenels.com**

**Distributors:**
Germany
Austria
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