Glass industry

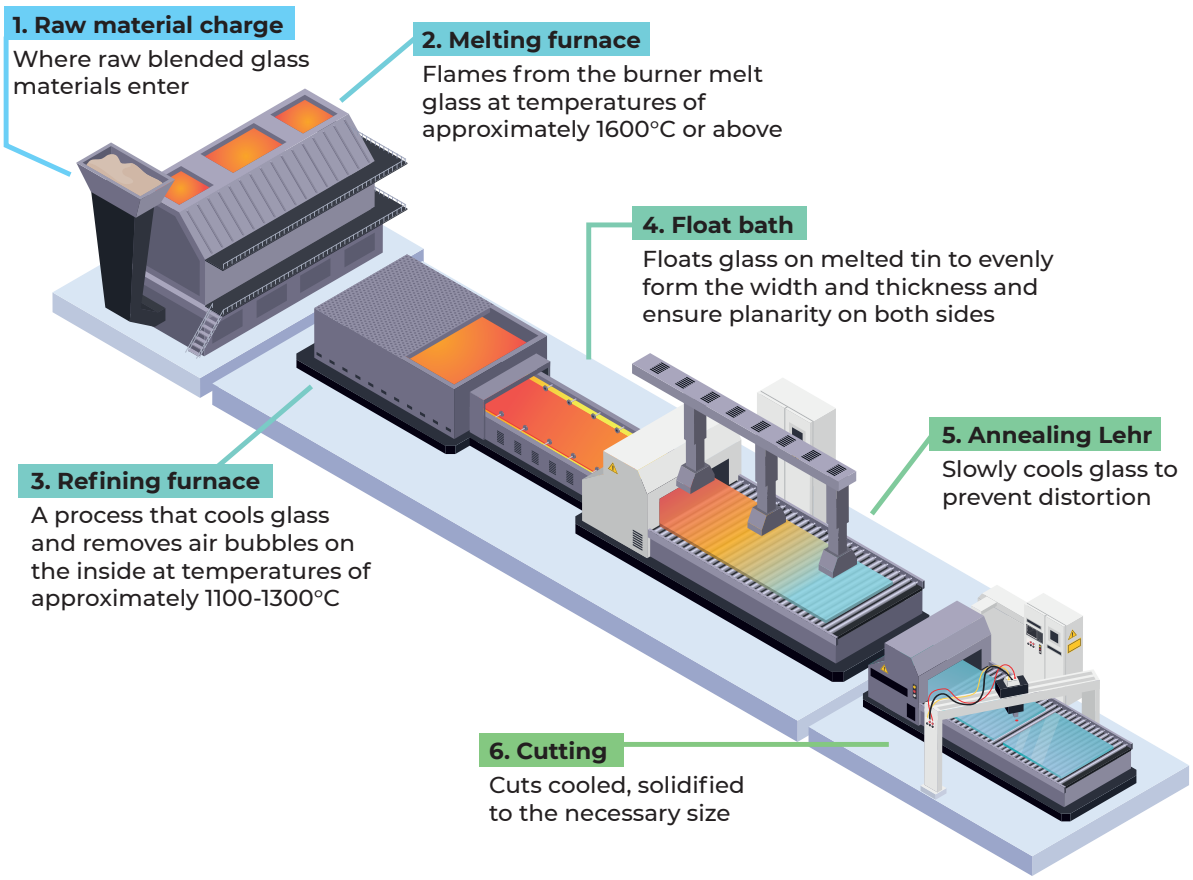
CD Automation, a leader in the control of heating elements, has been offering quality solutions in the field of industrial temperature control for over thirty years.
In the glass production process, controlling power and temperature throughout the various processing stages is of great importance. Therefore, supplying the glass industry with the highest quality thyristor power units and SCR power controllers is one of CD Automation's priorities. CD Automation provides comprehensive support services for the development, optimization, sustainability, and energy efficiency of thermal processes, thereby enhancing plant power quality.

Glass applications can be divided into two types:

Primary processing: raw materials such as sand are used to obtain glass and semi-finished glass products.

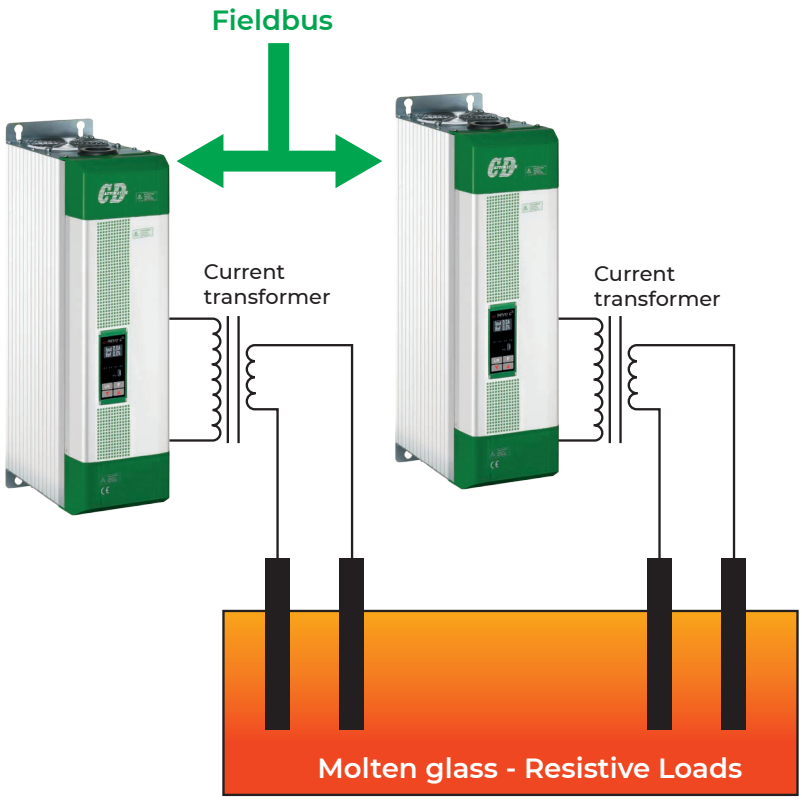
Secondary processing: involves transforming semi-finished glass into finished products.

CD Automation offers state-of-the-art products for temperature management and control in both categories.



Boosting power control and monitoring

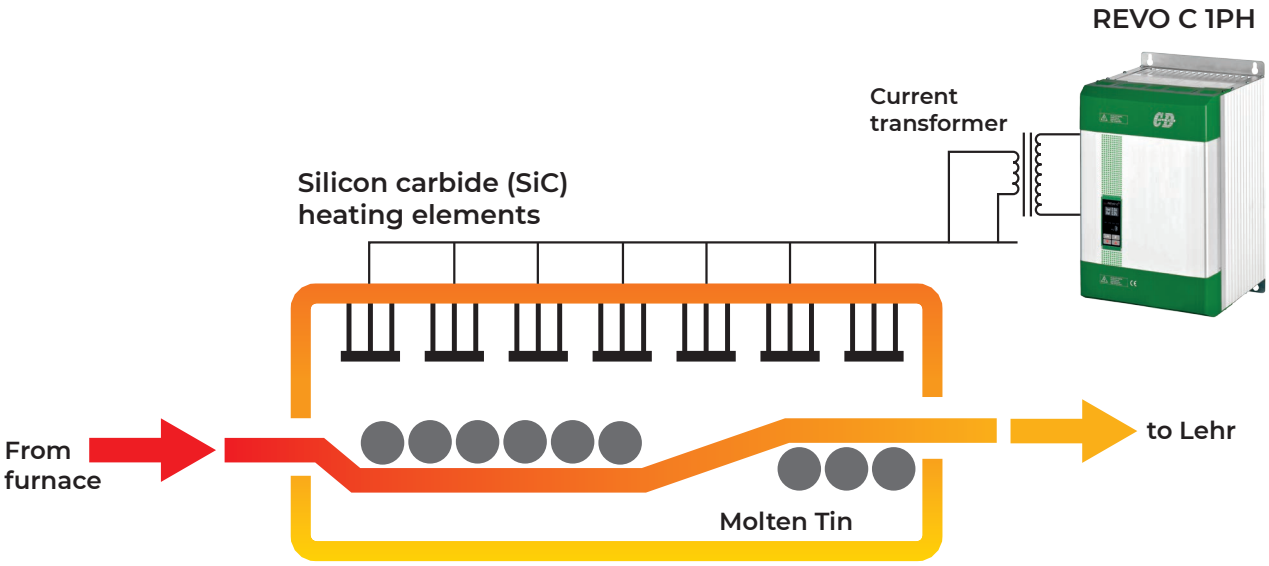
In the early stages of glass production, raw materials such as sand are heated and melted. Molten glass is a conductor of electricity. The passage of high currents through the glass produces direct heating of the resistance presented by the glass. This heating is advantageous because it warms the 'colder' lower glass in the furnace. The heated lower glass rises to the top, producing a stirring effect that promotes melting and heat transfer. Boosting is often utilized to address periodic fluctuations in demand or to sustain the extraction rate of a furnace toward the end of its operational life.



CD Automation manufactures thyristor units suitable for this type of application. With its engineering department, CD Automation is able to study the process, define the complete hardware and software system, carry out commissioning, and provide first-class service throughout the life of the system

Float Bath

The float bath on melted tin serves as the crucial forming stage in flat glass production. Here, glass is extracted from the furnace at a blistering 1100°C, gradually cooling to solidify at 600°C as it moves through the bath.
During its time in the tin bath, the glass undergoes essential processes including heating, fire polishing, and controlled cooling.
Precise temperature control is essential in modern flat glass systems to effectively manage all zones, guaranteeing product quality and optimising consumption.
CD Automation SCR units have an optimization algorithm for SiC heaters.



Silicon Carbide heating elements

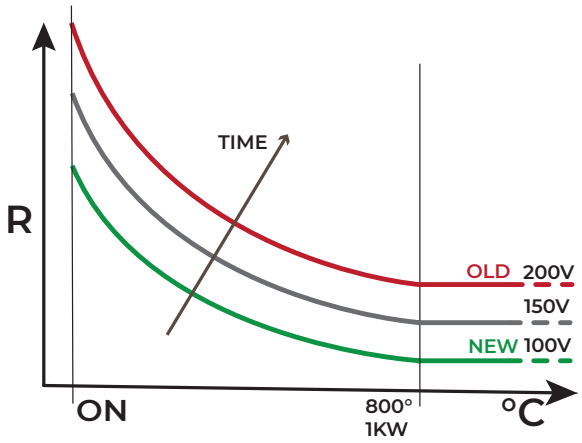
Silicon Carbide is a semiconductor material, and has a much higher resistivity than metallic resistance materials. Room temperature resistivity is fairly high, and falls with increasing temperature to a minimum value at about 600-900°C; at elements temperature above 900°C resistivity increase with rising temperature.

The Silicon Carbide (SiC) heating elements used in this phase exhibit specific characteristics:

Issue A: resistance **increases with prolonged usage and ageing**, requiring replacement when the resistors become less efficient.

Issue B: they have **high resistance when cold**, as they heat up, resistance decreases and stabilizes around 800°C or the designated operating temperature.

All these factors must be considered for the proper utilization of resistors, to prevent overheating or premature ageing.

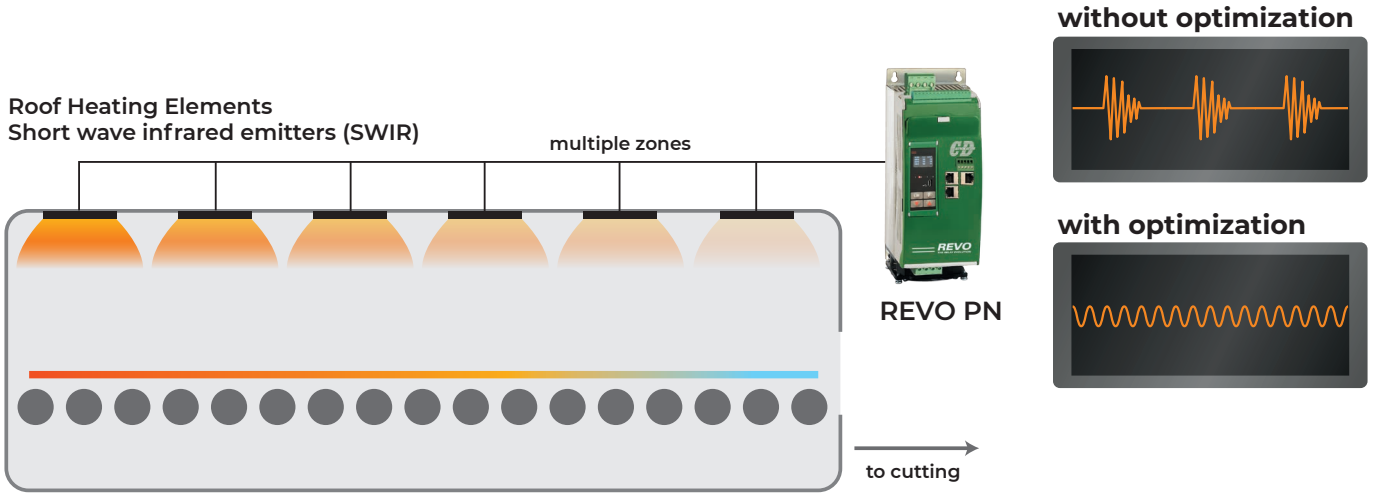


Solution A: Maintaining the target power of the process constant, such as 1KW at 100V, is crucial. Since power is determined by P=V^2/R and P=V*I, where R varies over time, adjusting the voltage to compensate is necessary. This allows for sustained efficiency over time until reaching the limit where further voltage increase is not feasible. At this point, the power decreases, indicating the need to replace the resistors.
REVO C 3PH can drive the voltage on the primary of the transformer, partialising it in **phase angle**, as in the graph above, by starting from 100V for the new one up to 200V for the old one.

Solution B: As previously mentioned, when starting 'cold,' the resistance (R) is much higher. Applying the necessary power, at full power risks prematurely ageing the resistors or even burning them out.
It's essential to introduce power gradually using a ramp and in an optimal manner. To achieve this adjustment, the **REVO C 3PH** can be used to control the voltage on the primary of the transformer by partialising it in **phase angle**.

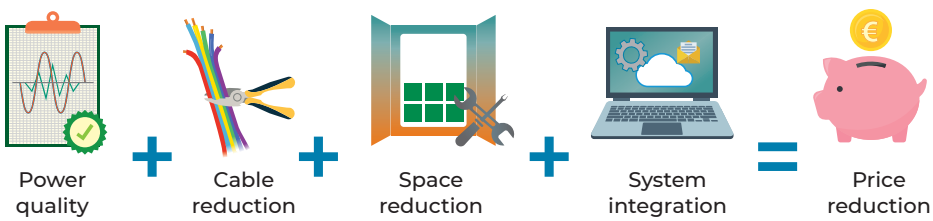
Annealing Lehr

The glass must be gradually cooled to a lower but still relatively high temperature on its way out, to prevent plate breakage and deformation. Typically, infrared or conventional heating elements operated in Burst Firing mode are used during this phase.
For this purpose, a **REVO C 2PH** is used with burst firing, eliminating the need for 3-phase control. Alternatively, other firing methods can be utilized depending on the type of heating element.
Also **REVO PN** or **REVO PC + REVO C** can be used to manage multiple zones and for **heating profile management**.



REVO PN Power Network is the most compact and flexible solution with synchronised firing (max. 25A).
High-performance SCR junctions for controlling complex loads such as short-wave IR emitters (IRSW) with high peak currents.

- For the control of 480V heating elements.
- Distributed solution with wiring contained in small integrated cabinets (plant/board).
- Ideal for controlling emitters/IR lamps in heating processes.
- Space-saving solution with 4 to 24 zones 25A output modules per fieldbus node, I/O modules and optional temperature control boards.
- Engineering Tools for TIA Portal® and Rockwell® PLC examples.
- Possible communication systems integrated in the unit: Profinet, Profibus, Ethernet IP and Modbus TCP.
- Free CD Automation software for configuration.

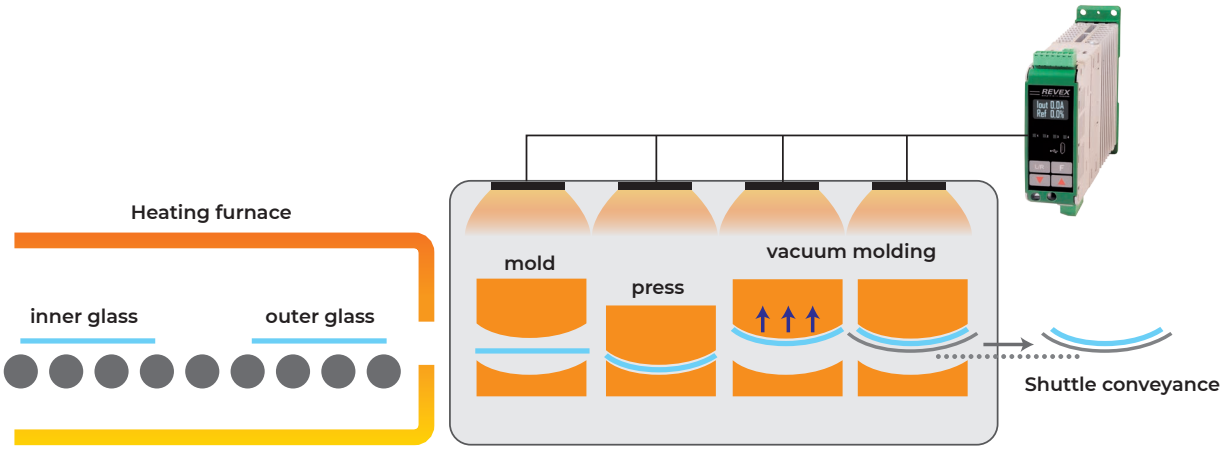


Laminating and bending plants

Alongside the process of tempering glass, which makes it safer in the event of breakage, the lamination process takes place. This process consists of joining several layers of glass with a plastic foil. In the event of breakage of the toughened glass, the fragments will remain attached to the plastic foil, minimising personal injury. In addition to this process, which is widely used in the production of windscreens, rear windows and car glass, there is often the process of bending and screen-printing glass.

With the thermal tempering process, the bending oven is heated to temperatures between 650 and 750°C until a fairly viscous sheet is obtained and adhered to a concave or convex mould positioned inside the machine. This is followed by a cooling phase, in which the glass remains compressed in the mould.

Normal heating elements are used for these processes, and very high precision in power control is required. CD Automation recommends its **REVEX**, **REVO C** or **REVO PN** power units, which are capable of very accurate power control in either **phase angle**, **single cycle** or **half cycle** firing.



Press and vacuum molding

REVEX solid state relays are universal, high-performance control units with flexible configurations. The main feature of these products is that they can be configured according to project requirements, eliminating unwanted options. This type of 'on-demand' solution makes it possible to optimise purchase costs.

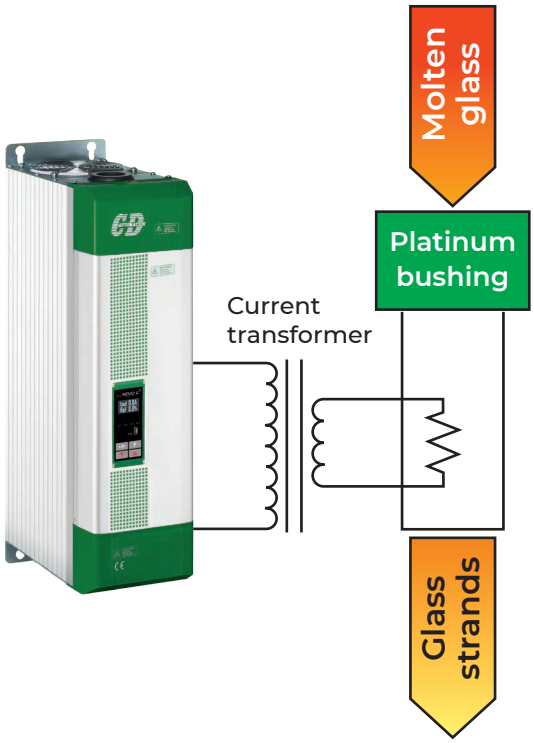
Some of the features of REVEX power controllers are:

- Integrated CT for current reading
- Configurable Heater Break alarm
- 2 configurable digital inputs (es: ENABLE function)
- 2 software-adjustable inputs without internal jumpers
- Firing: Single cycle, Half cycle, Burst Firing, Phase Angle, Delayed Triggering, different types of adjustable ramps
- Configurable feedback modes (V, V2, I, I2, VxI)
- Standard communication RS485 with Modbus RTU
- Free CD Automation software for configuration

Bushing temperature control

The production of glass fibres requires a high level of precision and reliability to achieve a consistent quality of the fibre produced.
Precise temperature control for this application is very important. We recommend the use of **REVO C 1 PH** with units ranging **from 800A up to 2100A:**

- Increased efficiency
- Improved recovery times
- Increased availability and productivity
- Monitoring of electrical process variables (voltage, current, power in kWh)
- **HB Alarm** to diagnose partial or Total Load Failure and Thyristor Short Circuit as an option
- Wide range of **communication protocols**: Control board has been engineered to plug on it different Field Bus boards
- **Energy Counter Totalize**r: This is available as an option and can be useful to define the cost per hour of heating system
- Guided **configuration via free software**
- Free **CD Automation APP** available for Android and IOS, for unit control with Bluetooth.



CD Automation for Glass Industry