

1 INFRARED HEAT MEETS ALL REQUIREMENTS

- Heat transfer is easy. It requires no contact with the material and no intermediate such as air or water.
- High power can be transmitted. Foils, plates and other shapes are heated in seconds.
- The heating process fits in easily with the manufacturing process.
- The process is economical because the heat loss is small as the heating effect is confined to the material to be heated.



INFRARED APPLICATIONS

There are different types of infrared: short, medium and long waveform. Let's see in particular the different kinds of infrared:

- a) short waveform: peak current ~ 7 times I nominal. Attention must be paid in sizing the thyristors
- b) ultrashort waveform: peak current ~ 16 times I nominal. Attention must be paid in sizing the thyristors
- c) medium waveform: I peak equal to I nominal. No attention must be paid to peak current
- d) fast medium waveform: These elements are in tungsten like short type and the peak current is lower but the necessary time to be heated is longer and this stresses the thyristors
- e) long waveform: I peak equal to nominal. No attention must be paid in sizing the thyristors

In car industry and in other special applications the short IRW are supplied with very low voltage compared with the nominal one to change the IRW penetration.

Cure must be used for these applications for current sizing of thyristors.

In fact, must be used the normal precaution for short waveform plus extra precaution for voltage supply lower than the nominal that causes a lower peak but a very long overcurrent that stresses the thyristors.

For sizing contact CD Automation, it will be necessary to collect more informations from the supplier of the IRW short.

Just like visible light, part of the broad spectrum of the IR radiation is reflected from the surface of the material, part is absorbed within the material and part penetrates through the material. The reflected component is usually very small. The component of the radiation spectrum which is absorbed is that which coincides with the wavelength of the molecular oscillation in the material. When the radiation is absorbed, it gives up its energy to the molecules so that the material is heated.

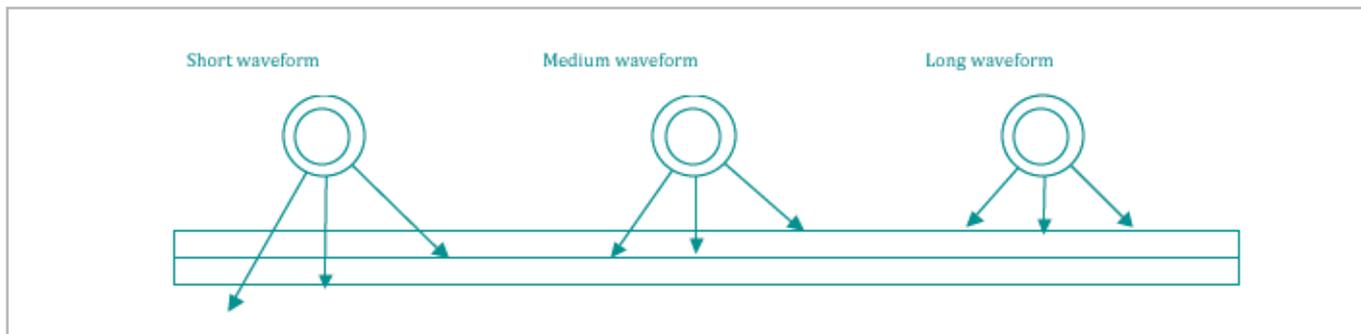


Figure 2. Penetration of different IR waveform

ELECTRONIC PANEL

CD Automation has developed a product range of Thyristor unit to drive IR. It's possible to drive power with different types of firing modes: Single Cycles, Burst Firing and Phase Angle.

CD Automation can provide a complete system including:

- Thyristor unit
- Temperature controller with Auto/Manual command.
The temperature on material can be detected with thermocouple or pyrometer



CURE OF INRUSH CURRENT ON SHORT AND ULTRASHORT IRSW

When there is inrush current, the first technique that an engineer can adopt is to limit it with Current Limit and Phase Angle firing. The current with Phase Angle and Current Limit is not really limited for the first 5 periods (100msec). In fact, Current Limit function is an electronic circuit that has a delay of ~ 100msec due to the current transformer inertia and passive components. See the graph below.

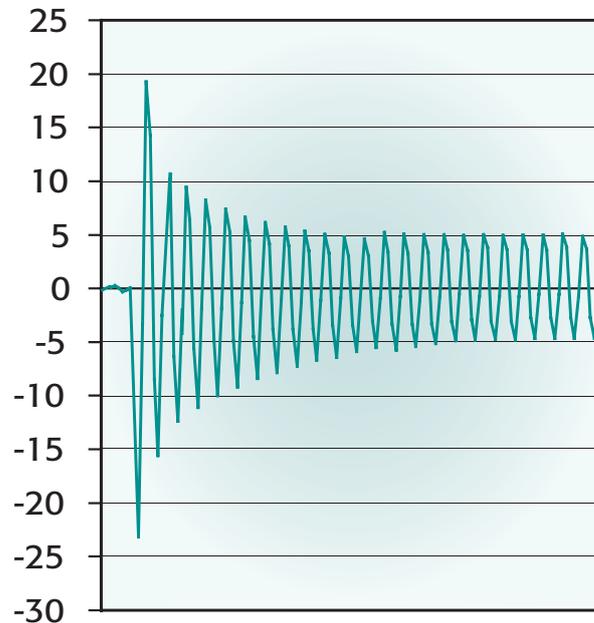


Figure 3. How Current Limit works: the graph represents the current absorption of a cold IR lamp starting with CL (10V 50ms)

To reduce this phenomenon is used a long soft start. Phase Angle technique with Current Limit cost more than Single Cycle technique, specially for 3 phase loads. In addition, the overload current remains for a longer time than with no Current Limit. This can be explained by the fact that short infrared are cold resistances. When these elements are cold there is the maximum current with low resistance. Increasing the temperature this will increase the resistance too. If we reduce the voltage, we reduce the energy supplied and it will take more time to heat itself. See the graphs below.

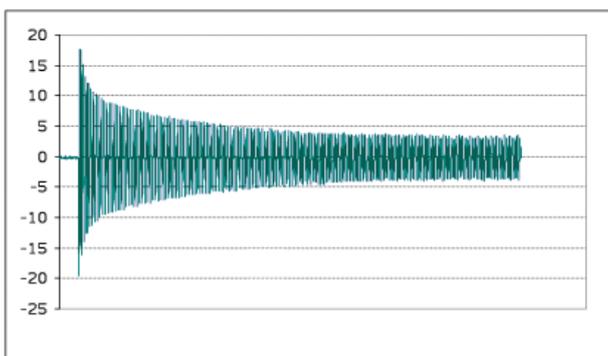


Figure 4. The graph represents the current absorption of a cold IR lamp with Current Limit (10V 500ms) and Phase Angle

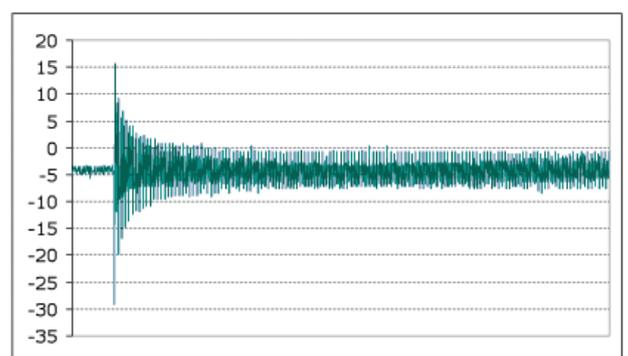


Figure 5. The graph represents the current absorption of a cold IR lamp without Current Limit using Single Cycle Firing.

As you can see in the above graphs, with Current Limit the inrush current remains high for a longer time.

BURST FIRING AND SINGLE CYCLE IN CONTINUOUS PROCESS

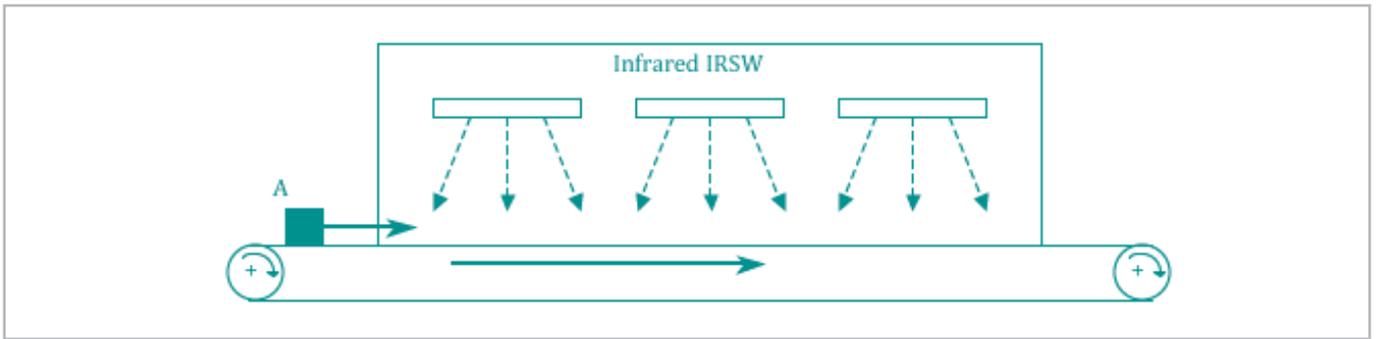


Figure 11. Tunnel furnace for heating treatment

In the figure 11 is shown a tunnel furnace for the heating treatment of product A (on the left). The product is moving on the conveyor at high speed to increase production.

Let's say that the product takes 5 seconds to go through the tunnel and power demand is 50%.

If cycle time (time ON + time OFF) is 20 seconds the ON time will be 10 seconds, then could happen that the product A will not be treated because the transit will be in OFF time.

Now, if we use cycle time of 40msec (20msec ON + 20 msec OFF) we are sure that the product will be treated.

CD Automation Thyristor units can be set in power for a fixed speed value of conveyor and compensated for speed variations.

If we twice the speed, then the power will also become double.

SYSTEM ARCHITECTURE FOR INFRARED

On next page you find a block diagram where inside there is REVO PC for Power Load Management (this unit it's a option).

See features and benefits on REVO PC bulletin.

INFRARED LAMPS SYSTEM ARCHITECTURE



ETHERNET
MODBUS/TCP



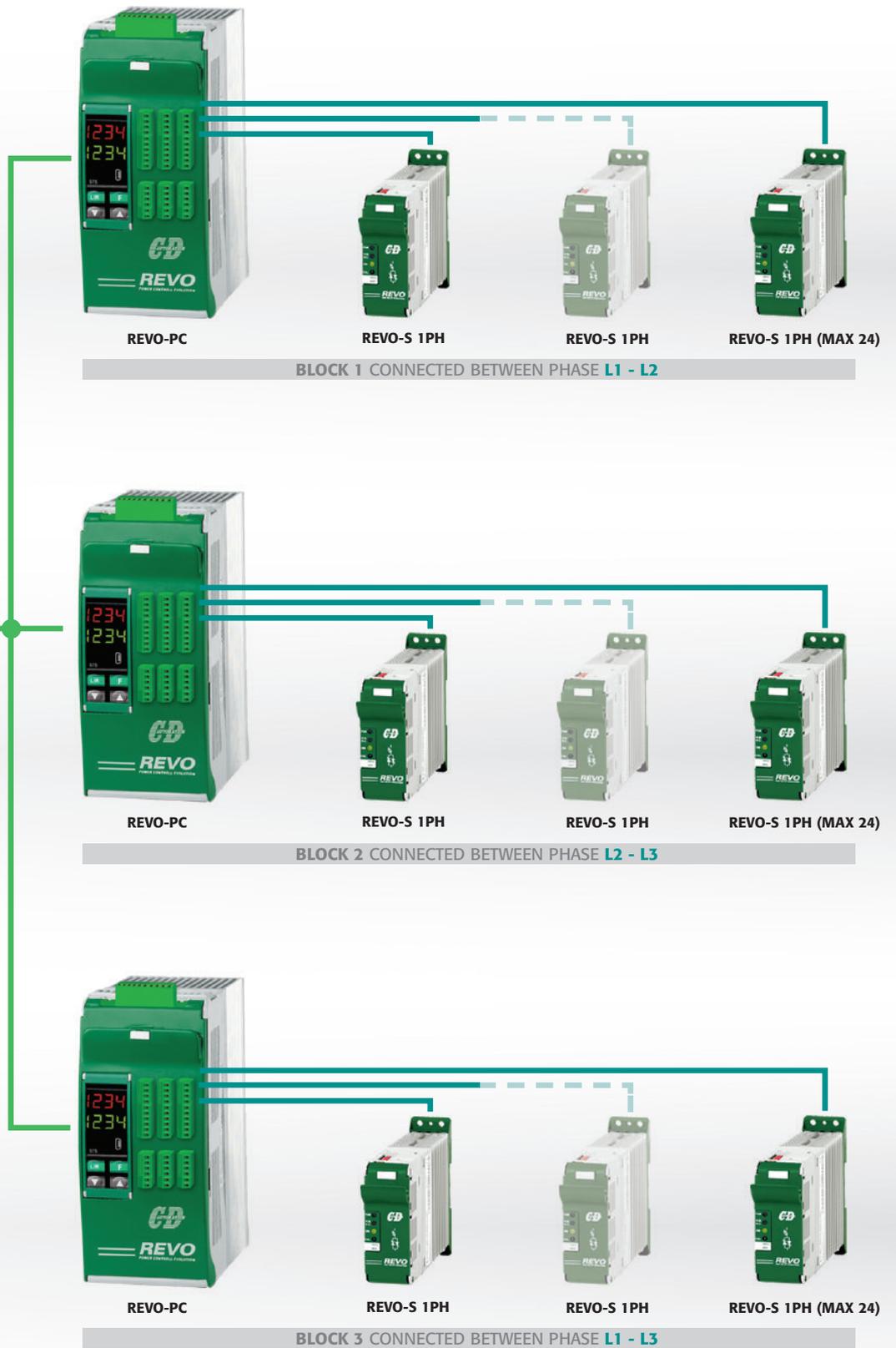
GTW2

ETHERNET
MODBUS/TCP

REVO TCM (1)



INFRARED
SENSOR



Note (1): Temperature Controller to trim up-down the power of each zone