

**FCOG1200 REVISION F "AUTO-BALANCE" CIRCUIT
AMPLIFYING INSTRUCTIONS****Introduction**

The FCOG1200 board was introduced in 1991 in order to meet the growing demand for 12-Pulse power conversion. This demand was fueled by the increasingly stringent Total Harmonic Distortion (THD) specifications being imposed by local utilities. The use of a 12-pulse controller virtually eliminates the 5th and 7th harmonic and thereby lowers the systems THD.

Ideally, the phase shift transformer that powers the two 6-Pulse thyristor bridges, which make up a 12-Pulse converter, provides two sets of three phase voltages equal in amplitude and phase shifted by 30°. In practice, transformer imperfections cause a small open circuit voltage unbalance, impedance unbalance, and a slight deviation from 30° phase shift. As a result, individual bridge currents of the parallel 12-Pulse converter become unbalanced, the 5th and 7th harmonics of the ac mains current are not completely canceled, and a dc ripple voltage at six times the mains frequency appears on the converter output.

The upgraded FCOG1200 firing board provides three means of adjusting the nominal 30° group delay in order to optimize the system performance. This optimization will allow you to balance the bridge currents, thereby minimizing the ac current harmonics and dc ripple voltage. The three methods are outlined below:

On-Board Trimpot Adjustment

This, the simplest means of control, is the default configuration of the FCOG1200 firing board. For on-board trimpot adjustment the FCOG1200 is configured as follows:

R11	Installed (25.0k pot.)	R51	Installed (100k)
R48	Omit	U12	Omit
R49	Omit	JU4	Omit
R50	Installed (100k)	JU5	Omit

With this control method you will optimize the 12-Pulse system for operation at a particular current level. This will ensure that the system provides balanced six phase current and minimum THD at the optimized current level. However, as the dc current diverges from this optimum level the transformer and firing board imperfections will cause the phase currents to diverge. This, in turn, will cause an increased THD level on the ac mains.

Adjustment is performed by setting the dc output current at the desired level. Once you have reached the desired level, monitor the input currents to the individual bridges and the dc output current. Adjust the on-board trimpot, R11, as required to obtain balanced bridge input currents (if required, adjust the command signal as necessary to maintain the desired dc output current).

On-Board Auto-Balance Control

This control method provides active control of the 30° group delay in order to optimize the circuit at all dc output currents. Implementation of this control method requires two customer provided current feedback signals, labeled "x" and "y" in Figure 1. These current feedback signals may be derived from the bridge ac input currents, as shown, or from the individual bridge output currents. The feedback signals should be of equal amplitude, approximately 1.0 -

5.0Vdc. The feedback signals are then applied to J6 pins 14 and 15 on the FCOG1200 board and the FCOG1200 board is configured as follows¹:

R11	Omit	R51	Installed (100k)
R48	Installed (10.0k)	U12	Installed (MC14070BCP)
R49	Installed (10.0k)	JU4	Omit
R50	Installed (100k)	JU5	Omit

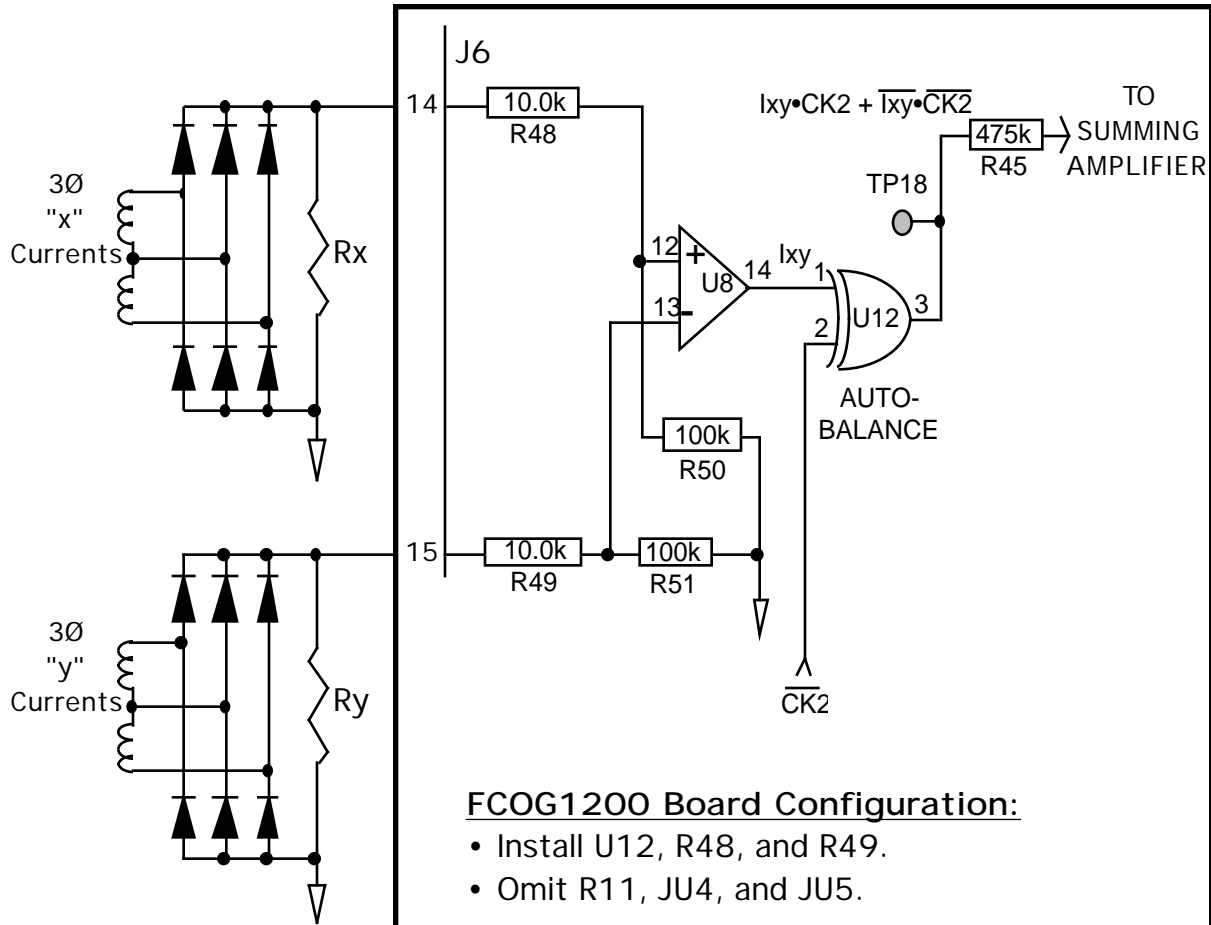


Figure 1. On-Board Auto-Balance Circuit

This circuit operates by injecting a high frequency ($6 \cdot f_{mains}$) square wave into the Voltage Controlled Oscillator (VCO) summing amplifier. This square wave serves to increase the delay angle (α) of the high current bridge while reducing the delay angle of the low current bridge. These delay angle adjustments will actively equalize the bridge input currents thereby ensuring optimum system performance.

External Auto-Balance Control

The FCOG1200 Revision F firing board can also be controlled by an external auto-balance circuit. This circuit will perform the same functions as the on-board auto-balance circuit but could also provide regulation (closed-loop control). In this mode the FCOG1200 board is configured as follows²:

¹ The FCOG1200 board can be supplied with this configuration. Please request that the boards be configured for "on-board auto-balance" when ordering.

² The FCOG1200 board can be supplied with this configuration. Please request that the boards be configured for "external auto-balance" when ordering.

R11	Omit	R51	Omit
R48	Installed (10.0k)	U12	Omit
R49	Jumper	JU4	Installed
R50	Omit	JU5	Installed

The high frequency ($6*f_{mains}$) output of the external auto-balance circuit should be connected to J6 pin 14 of the FCOG1200 board. If desired, the external circuit can obtain the CK2 and NOT(CK2) signals at J6 pins 15 and 13, respectively.