

**MF-PAK/50 –
WS700ms
User Manual**

Manual version 1.00
Part Number 91-00-50



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Notice

This manual is subject to change without prior notice or legal responsibility.

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Introduction

The BF Entron MF-PAK/50 inverter provides the energising power for a medium frequency welding transformer, replacing the thyristors of 50/60 Hz welding systems. The unit is powered from a standard 3 phase supply and provides either a 4kHz or 2kHz output. A WS700ms timer unit is fitted into the inverter cabinet, thus providing a complete integrated control system. This manual covers the MF-PAK/50 inverter only. Please refer to separate manual for details of the WS700ms timer.

Features of the MF-PAK/50

- Uses three phase supply
- Balanced mains loading
- Capacitive mains loading improves factory power factor
- 50/60 Hz operation
- 4kHz/2kHz output
- Air cooled
- Maximum weld time 2 seconds
- High speed constant current operation
- Primary or secondary current regulation
- Controlled by conventional thyristor drive signal or millisecond timer
- Selectable current upslope
- Presetable current limit
- Diagnostic outputs

Safety

With all electrical equipment it is important that electrical safety is considered at all times.

Electrical Hazard !

- Before opening any electrical panel ensure that the mains supply to that panel is removed and that any breakers are clearly marked or locked to prevent other personnel from closing the breaker.
- Always follow your plant operating procedures for handling mains voltages.
- Ensure that the panel is safe by measuring the voltages from phase to phase and phase to earth to ensure that the equipment is safe.
- Before performing operations on the electrodes, welding transformer or associated cabling ensure that the controlling equipment is isolated from the mains.
- The inverter unit contains capacitors that remain charged to a lethal voltage for several minutes after switch off, or removal of power. It is imperative, if working on the equipment, to allow 5 minutes after power-down for the capacitors to discharge to a safe level, before opening the inverter cabinet.
- All resistance welding creates a large magnetic field in the area of the welding electrodes and the cables or conductors connected to them. This magnetic field could impair, or prevent correct operation of pacemakers.

Installation

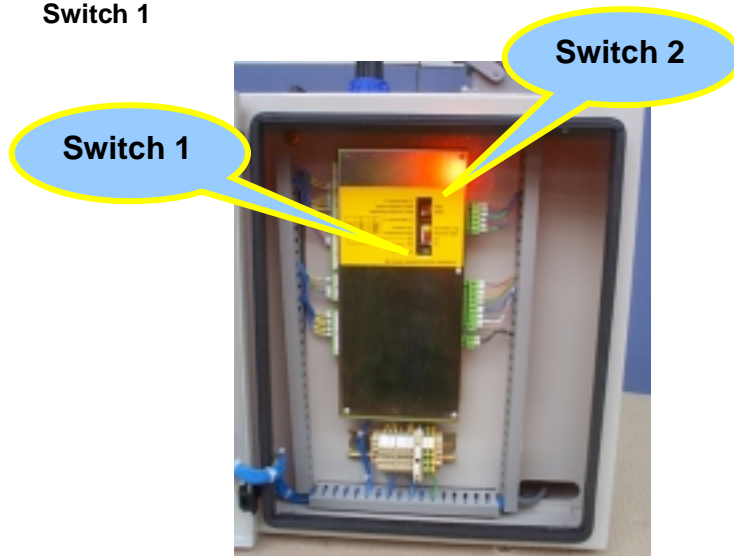
- Secure the Inverter in the required location.
- Connect 380 – 480 volt 3-phase and earth to the MF-PAK, via the connector. Phase rotation is not important. Current requirement is 32 amps
- Connect the welding transformer to the inverter with the cables supplied.
- Connect the transformer output to the tooling.
- **IMPORTANT!** The transformer output ***must be earthed*** separately. Usually, this can be done by earthing the static part of the tooling. Use an earth conductor having a minimum cross-sectional area of 6 sqmm.

Setting Operating Options

To select the required operating mode it is necessary to set certain switches and links. These are found on the circuit board on the inside of the cabinet door. Refer to the label on the unit.

Any changes to the operational settings must be made whilst the unit is powered down.

Switch 1



Transformer Type

Set switches 1.1 and 1.2 in accordance with the table shown on the label, to set the maximum primary current.

Timer Type

Set switch 1.3 to select 'Millisecond timer'.

A millisecond timer is a timer designed specifically for Medium Frequency welding, and the time intervals are programmed in milliseconds. This unit is fitted with a WS700ms millisecond timer.

Regulation Type

Set switch 1.4 to select either primary or secondary current regulation. Under normal circumstances secondary regulation would be used because this takes the welding transformer and secondary circuit into the feedback loop. Primary regulation would be used where there is no toroid on the transformer secondary, or where short weld times are used.

Switch 2

Switching Frequency

Switch 2.1 selects either 4 kHz or 2kHz operation. Note that the BF Entron transformer 90-00-01 is designed for use at 4kHz.

Mains Frequency

Switch 2.2: this function is not used on this equipment. The switch can be set to either position.

Current Limit

The primary current of the transformer can be limited to a percentage of its maximum capability (as set on switches 1.1 and 1.2).

Connect a 0 – 10 v DC meter to the connection points indicated.

0.1 volts represents 1%

10.0 volts represents 100%

Voltage range 2.5 to 10.0 volts

Adjust the Current Limit preset to get a voltage representative of the % required.

Example:

If using a maximum primary current capability of 2500 amps, and a limit of 2000 amps needs to be imposed:-

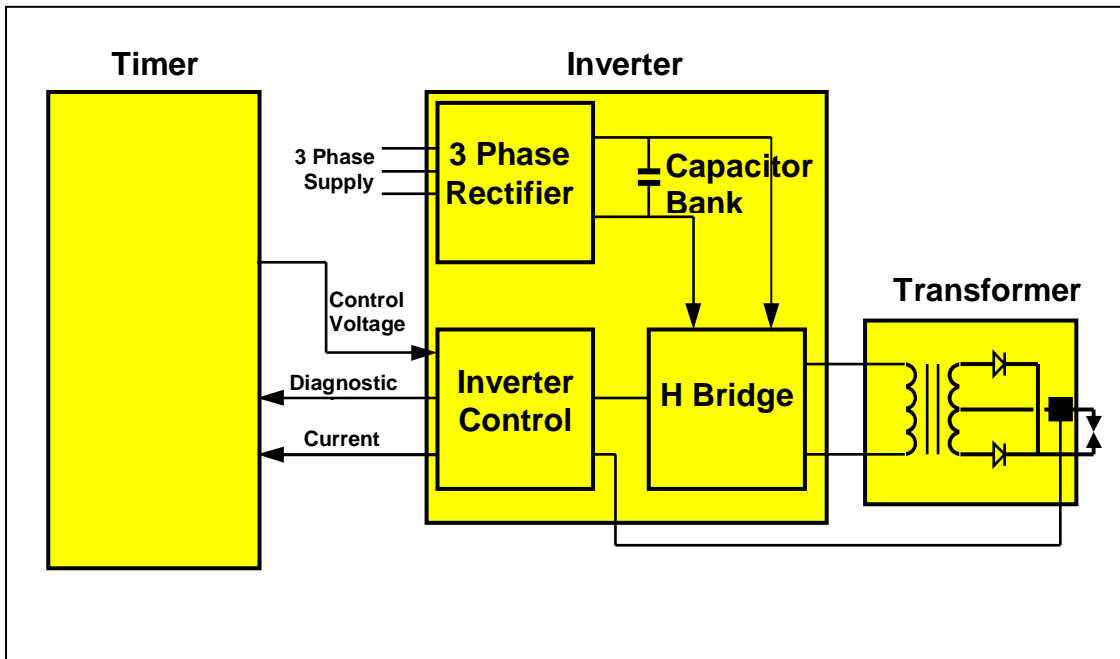
$$\frac{2000}{2500} \times 100\% = 80\%$$

$$80 \times 0.1\text{v} = 8.0 \text{ volts}$$

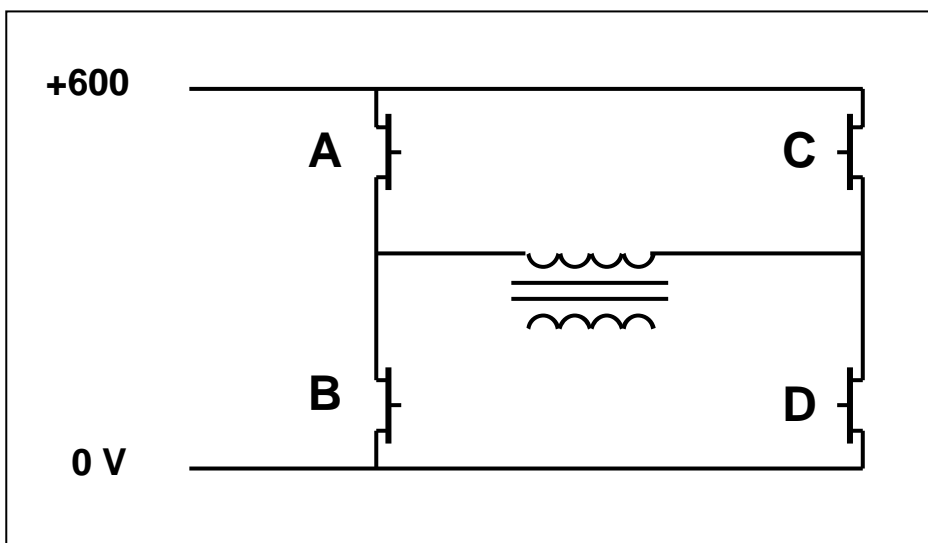
Therefore adjust Current Limit preset to get a voltage of 8.0 volts, and hence a current limit of 2000 amps.

Functional Description

The purpose of the Medium Frequency Inverter is to take a three phase factory supply and produce 4kHz or 2kHz AC power for a welding transformer. The power to the transformer is controlled by the inverter, which is, in turn, controlled by the weld timer.

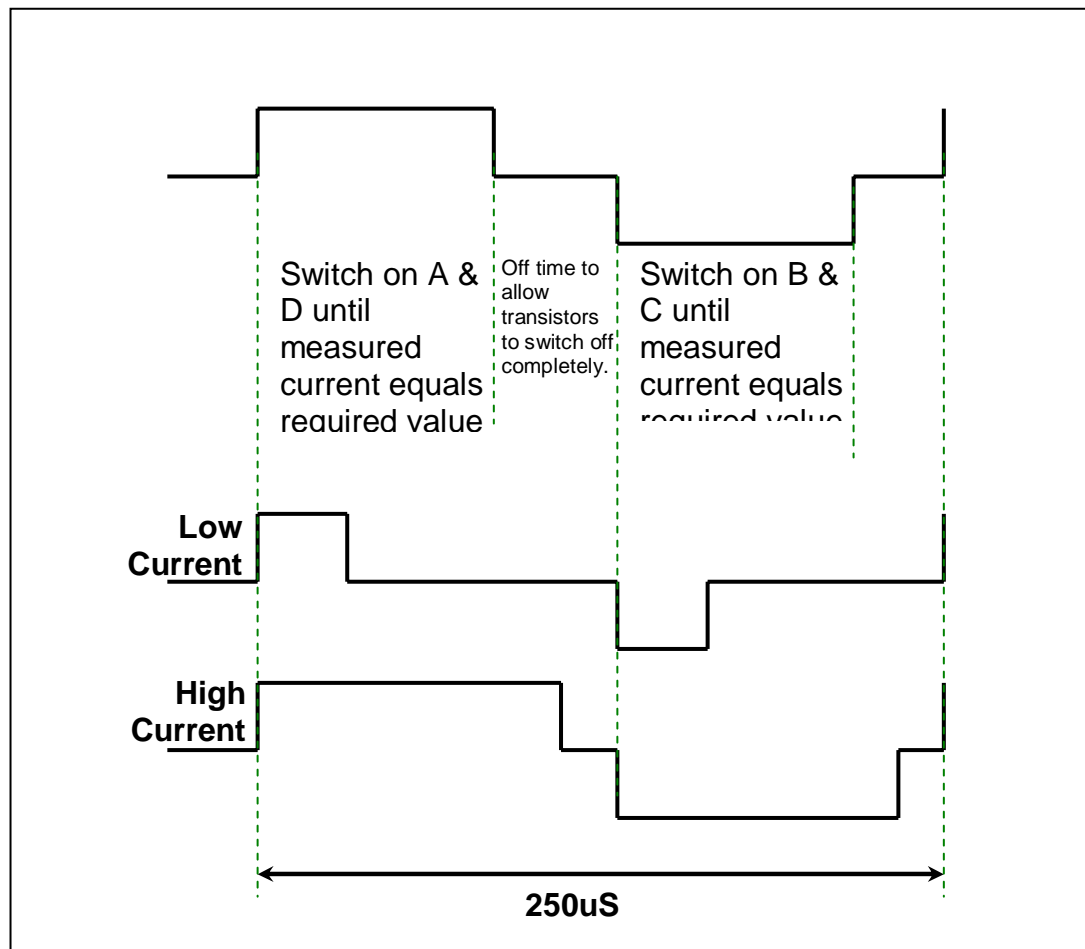


The power side of the inverter consists of a three phase full wave bridge rectifier producing about 600v DC from the factory supply. This supplies four power transistors in an "H" configuration.



"H" Configuration of transistors

When activated by the weld timer, the control circuit switches on transistors A and D until the current reaches the required level. The transistors are switched off and the back emf, produced by the transformer, absorbed by the capacitor bank. Transistors B and C are then switched on until the required current is reached. This energises the transformer in the opposite direction. The switching between pairs of transistors continues at a rate of 4 kHz (or 2kHz according to switch setting), current is controlled by changing the mark/space ratio.



Diagnostics

The MFPAK/50 provides a diagnostic output code. These are interpreted by the timer unit, and shown on its display.

Short Circuit

Inverter output is short circuit. (Condition detected by sensing a large excess of output current.) Either the output wiring or the weld transformer primary winding is short circuit.

Ground Fault

One, or both, of the transformer primary connections are shorted to Earth. Check primary wiring and transformer.

Transformer Temperature

Transformer overheated. (Condition detected by normally closed thermostat going open circuit.) Allow transformer to cool. If condition frequently returns, reduce welding duty cycle.

Inverter Temperature

Inverter heatsink over temperature or cooling fan fault. (Conditions detected with thermostat.) Check fan is turning. If it is not, return the inverter to BF Entron. If the fan is working, allow inverter to cool. If problem persists check that the inverter is adequately ventilated and that the duty cycle is not excessive.

Bus Voltage

The internal DC supply for driving the power transistors and the weld transformer is outside the specified limits of 440v to 800v. Check that all three mains phases are present. Check mains voltage.

No Secondary Current

The inverter has "welded" and no secondary current was measured. Check:

- Electrodes closed
- No insulating material preventing electrode contact with component
- Toroid connections
- Secondary circuit
- Primary circuit
- Inverter output


Maximum Pulse Width

This warns when the inverter has produced 128 pulses (64 inverter time periods) with the maximum pulse width, in any single weld period. The inverter is working at, or above it's maximum rating. Reduce current demand.

Maximum Primary Current

The Primary Current warning is given when the level set by the Current Limit preset is reached.

Reset

Press the  key on the timer to clear all error indications and Fault Output Bits. If the fault is still present the indicator and Fault Output Bits will immediately be reinstated.

Specifications

Inverter Specification

Mains supply	Three phase
Mains voltage	380v to 480v
Mains frequency	50Hz or 60Hz
Switching frequency	4kHz or 2kHz
Max. o/p current	50A
Max. weld time at max current	2 seconds
Current regulation	Primary or secondary
Dimensions (not including connectors)	460x400x350 mm
Weight	~30 kg

Timer specification

Please refer to WS700ms timer manual.