

MUREX Sabre-arc 35i/PT-50

General Comments

The Sabre-arc 35i is an inverter based air plasma cutter for metals up to 12mm (½") thick. It utilises the PT-50 plasma torch (same as Sabre-arc 40i) and is rated at 35A at 40% duty.

The unit is available in 2 versions:

230V, 1 phase, 20A fuse
415V, 3 phase, 10A fuse

Note that the 2 units are externally identical except for the primary cable (and rating plate).

The 35i utilises HF to initiate the arc, but there is no pilot circuit. The PT-50 torch incorporates an air valve, which in combination with a flow switch in the power source, provides "parts in place" protection - removing the shroud from the torch closes the air valve in the back of the torch head. Whilst no air can flow, no OCV can be present.

The 35i uses IGBT technology (Insulated Gate Bipolar Transistor), incorporating two IGBT's in the single phase and one IGBT in the three phase version, each IGBT comprising two transistors.

The main control pcb provides current control (feedback from a shunt), control of the air and HF circuitry and other functions. The circuitry utilises a PIC (Programmable Integrated Circuit) which provides all the logic functional controls.

CIRCUIT DESCRIPTION

Mains Input Circuitry

The mains supply input (either 3 phase 415V or 1 phase 230V depending on model) is supplied to the primary rectifier bridge IBR via the input on/off circuit breaker CB1 (rear panel) and an EMC filter.

The mains supply also feeds the auxiliary transformer T2 and fan motor M1 (230V) via protection fuse F1. On the 3 phase 35i only 2 phases are used for this purpose and T2 acts as an auto transformer to provide the 230V for the fan.

Primary Circuits

Main bridge IBR rectifies the incoming supply providing around 320Vdc (1 phase unit) or 550Vdc (3 phase unit). In addition the bridge incorporates a thyristor in its positive output leg which is gated by signals from the main control PCB1. Resistor R10 bypasses the thyristor initially soft charging the dc capacitor bank consisting of parallel capacitors C1,2 etc. Note that inductor L2 limits the rate of rise of current from the supply. When the torch switch is operated the dc thyristor is gated, effectively bypassing R10, making available full power from the bridge and supply.

The IGBT/s are arranged in bridge configuration feeding the main transformer, the individual transistors being gated alternately (in pairs in the single phase), effectively supplying ac power to the primary of ferrite cored main transformer T1 via capacitor C4. A current transformer T4, in series with the main transformer primary, monitors primary current sending signals to the main PCB1.

Correctly timed gate signals are fed from the main PCB1 (via driver PCB2 and PCB3 in the single phase) and PCB3 only in the 3 phase versions these are mounted on the actual IGBT modules. **Note:** always replace the driver pcb when replacing a failed IGBT module.

Main Secondary

The secondary of main transformer T1 is full wave rectified by modular bridge rectifier D1 and power is fed to the torch electrode (-ve) via smoothing inductor L1 and HF coupling transformer T3. A dc shunt SH in the work side (+ve) feeds current signals back to main PCB1. An HF bypass and "Easy Start" network (resistors and capacitors) is incorporated on PCB5 across the machine output.

The HF generator consists of high voltage transformer T5 which is fed with 115Vac from the main PCB1. The secondary of T5, around 3500V, is coupled to the primary of coupling transformer T3 via spark gap SG and capacitors C13/C14. **Note:** the spark gaps are set at the factory at 0.020 - 0.025ins (approx 0.5mm).

Electronic Control

Auxiliary ac supplies for main PCB1 are generated by transformer T2. **Note:** there are 6 separate auxiliaries which include 115Vac for the HF generator, this 115Vac also supplies the on/off white pilot light PL1.

The front panel current control pot R1 (10K) supplies 0 to 5Vdc as the current reference to the main pcb. A normally closed thermal switch TS1 is installed to protect the unit which also inputs to the pcb. Note, if TS1 contacts are open 5Vdc will exist across it and the fault lamp PL2 will be illuminated, supplied from PCB1.

The main PCB1 drives the gas solenoid valve SOL1 with 24Vac. **Note:** when the front panel air check switch S1 is operated air will flow continuously and cutting is not possible. A flow switch FS, in the air line to the torch, confirms air is flowing and inputs to PCB1 together with signals from the check/run switch S1. S2 is the lock/unlock switch. When S2 is operated (closed) the torch switch J1 is electronically latched and can be released once current is detected as sensed from the shunt SH. Either re-operating the torch switch or pulling the torch away from the work will stop the arc and reset the system.

Referring now to the main PCB1. Low voltage dc supplies are 24V unregulated (VBIAS), +15V, +12V & -12V developed by regulators VR1, VR2 & VR3 respectively and a + 5V supply developed by IC6, the pulse width modulator. TPO & TPOO are signal ground and TP1, TP2, TP3 & TP4 can be used to check the regulated supply voltages.

LED1 indicates the torch switch has been pressed, LED2 indicates that relay K1 is powered turning on the HF, and LED3 indicates relay K2 is powered turning on the solenoid valve.

The input from the flow switch should be 0v if enough air is flowing and the switch is operated (5V if not). Similarly the input from the thermal switch should be 0v if the machine is not overheated (5V if it is).

IC3 monitors the unregulated 24Vdc VBIAS voltage, and hence the mains supply. If it rises above 10% then the unit is shut down and the fault light PL2 is illuminated by a signal from IC5 driven by the PIC IC2.

Preset R14 sets the post flow air time, normally around 10 seconds.
Preset R53 sets the primary current limit, ex primary current transformer T4.
Preset R51 sets the minimum pulse width on the inverter IGBT drive.
Preset R36 sets the inverter frequency.

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BILL OF MATERIALS

QTY	REF	DESCRIPTION	MANUFACTURER
1	IC1	7815	GENCO
1	IC2	PIC16C71	GENCO
1	IC3	7805	GENCO
1	IC4	7812	GENCO
1	IC5	7809	GENCO
1	IC6	7805	GENCO
1	IC7	7812	GENCO
1	IC8	7805	GENCO
1	IC9	7815	GENCO
1	IC10	7815	GENCO
1	IC11	7815	GENCO
1	IC12	7815	GENCO
1	IC13	7815	GENCO
1	IC14	7815	GENCO
1	IC15	7815	GENCO
1	IC16	7815	GENCO
1	IC17	7815	GENCO
1	IC18	7815	GENCO
1	IC19	7815	GENCO
1	IC20	7815	GENCO
1	IC21	7815	GENCO
1	IC22	7815	GENCO
1	IC23	7815	GENCO
1	IC24	7815	GENCO
1	IC25	7815	GENCO
1	IC26	7815	GENCO
1	IC27	7815	GENCO
1	IC28	7815	GENCO
1	IC29	7815	GENCO
1	IC30	7815	GENCO
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1	IC40	7815	GENCO
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1	IC42	7815	GENCO
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1	IC93	7815	GENCO
1	IC94	7815	GENCO
1	IC95	7815	GENCO
1	IC96	7815	GENCO
1	IC97	7815	GENCO
1	IC98	7815	GENCO
1	IC99	7815	GENCO
1	IC100	7815	GENCO



