TRANSMIG 450i

CONTROL PCB

CC Select

Switching the switch to cc on the HC-4B grounds P3-3. This switches on Q12 thereby taking IC3 pins 8 & 9 to +12V resulting in IC3 pin 10 going low (ov). - STKB.

Providing both thermal switches (connected in series between P3-9 & P3-10) are closed IC8 pins 12 & 13 are low thereby making IC8 pin 10 go high. - STKENB

It can also be seen that Q12 also takes the "STK" signal to +12V thereby enabling the bilateral switches IC15 pin 5 & IC1 pin 12 which routes and selects the cc reference through to the pulse width modulator. (see CC Ref. section)

Enabling the CC Output

Switching the contactor switch on the HC-4B remote unit to the "on" position switches on opto isolator IC6 thereby connecting +12V to IC7 pin 1. As described in the cc select section the other input to IC7 pin 2 "STKENB" is also at +12V. IC7 pin 3 therefore goes low.

The "MIGENB" signal on IC7 pin 9 is low (because we are in the cc mode ie. IC8 pin 6, IC7 pin 8 is also low at this time) IC7 pin 12 is high making IC7 pin 11 high. Therefore provided that the "over voltage" circuit has not activated ie. IC9 pin 6 is high (see Over Voltage section) IC7 pin 4 goes low thereby removing the inhibit signal from the pulse width modulator IC4. Activating the PWM fires Q6 and Q18 in anti phase thereby switching ov through to pulse transformers TR2 &TR3 which in turn will switch on the main power FET bridges which will provide the 450i ocv output. (The switching frequency approx. 22 KHz is determined by components R76, R75 & C18).

CC Reference

A 0 - 10 volt cc ref is applied by the amps potentiometer of the HC-4B to P2-1. This reference is fed through IC15 pins 3 & 4 (the bilateral switch) which had previously been enabled by "STK" signal, (see CC Select section) to OP3 pin 2. The more positive the cc reference goes OP3 pin 1 goes more negative. This signal is fed through R36 where it is summed with an amplified shunt signal feedback. The shunt is connected between P1-2 and P1-1 into OP2 whose output on pin 6 is then summed with the cc reference. The result of this summation (error signal) is then amplified by the error amplifier OP1 whose output pin 14 is connected to the non-inverting input of the PWM IC4. Therefore the more positive the error signal the longer pulse width is applied to Q18 & Q6.

MIG CV Enable

With the mode selection switch on the HC-4B set to the cv mode Q12 is held off thereby switching IC8 pin 6 "MIGENB" to +12V (providing both thermal switches are closed).

With the contactor control from the W.F.U. connected between P4-7 and P4-8 the MIG torch switch switches on opto isolator IC5 thereby connecting +12V to IC7 pin 8.

IC7 pin 10 goes low causing pin 11 to go high. Therefore providing the over voltage circuit is not activated, IC7 pin 4 goes low activating the pulse width modulator.

CV Output Control

The cv reference is applied via P2-8 to OP1 pin 2. The more positive the cv reference the more negative OP1 pin 1 goes. Here the amplified reference signal is summed with the voltage feedback from the arc "VARC" which enters the PCB via P2-10. (Note "VARC" is referenced to the positive welding output).

The result of this sum (the error signal) is fed into OP1 pin 6, the error amplifier. The magnitude of this amplification is determined by R6 or R139, whichever resistor is switched in circuit by the slope selector switch and the bilateral switch IC14. (see slope select section)

This error signal is then supplied to the variable inductance control potentiometer (between P2-3 & P2-4). The position of this potentiometer combined with R32 & C16 determines the systems reaction time to what is occurring in the arc and hence alters the dynamic characteristics. This signal is then applied through IC15 pin 2 & 1, which has been enabled by the "STKB" command from the cc/cv select circuit, to the same amplifier circuit that is utilised in the cc mode OP3. As previously described in the cc mode this signal is then compared with the shunt feedback before adjusting the reference level of the PWM. (See CC section for more detailed description).

MIG Slope Selection

The slope switch on the front panel is connected to P2-5.

In the "flat" position +12V is connected to P2-5 which turns on both Q16 & Q17. This therefore grounds both "S1" & "S2" signals to the bilateral switch IC14 pins 12 & 6 thereby altering the gain of the error signal in the cv control circuit.

In the medium position +5V is applied to P2-5 which switches on Q16 thereby grounding "S1" but because +5V is insufficient to break down zener diode ZD37, Q12 remains off thereby making S2 +12V thereby again altering the gain of the error signal by switching R139 into circuit.

In the steep position P2-5 is left floating which means neither Q16 or Q17 are on thereby making both "S1 & "S2" +12V.

Digital Voltmeter/Ammeter Control

The volt/amp selector switch is connected to P1-7.

Volts Selection

In this position P1-7 is connected to Ov this in turn switches on Q15 connecting +12V to IC8 The output IC8 pin 9 "VSI" goes low (0 volts). Q15 also connects +12V to opto isolator IC13 thereby connecting P1-9 to P1-8 and allowing the DVM to display a decimal point for the voltage reading.

Because "VS" is high this switches on IC1 (bilateral switch) which connects VARC, (positive output of 450i) which enters the PCB on P2-10 through to one side of the DVM via P1-4. The other side of the DVM being tied to ground which is referred to the negative output of the 450i via P1-3, hence providing the voltage reading.

Amps Selection

In the amps position Q15 is switched off thereby switching off opto isolator IC13 which will remove the decimal point from the meters display. At the same time IC8 pin 9 "VSI" is high which switches on IC1 pin 3 & 4 thereby connecting the positive side of the shunt "B" through to the ammeter, the other side of the ammeter is tied down to ground which is the negative side of the shunt, hence providing the amps reading.

Thermal Switches

The thermal switches are connected in series across P3-9 to P3-10. With the switches closed (normal position) 0 volts is connected to the base of Q3 thereby keeping it conducting which in turn applies +12 volts to the base of Q13 keeping Q13 switched on which then applies 0 volts to IC8 pin 4,5,12 & 13 which permits the "STKENB" & "MIGENB" functions to operate.

In the event of one of the thermal trips operating Q13 switches off taking IC8 inputs to +12V disabling either the stick or MIG functions. At the same time Q19 will switch off (because its base has been taken low) this will take P3-6 towards +12V which will then illuminate the thermal overload LED - PL2 whose anode is connected P3-6 and cathode to 0 volts.

Overcurrent Circuit

Current transformers CT1 & CT2 are connected across P4-1 to P4-2 and P4-4 to P4-5 respectively. When the current detected by CT1 or CT2 exceeds a preset level Q11 is switched on which in turn switches on Q9 whose collector goes to +12V thereby inhibiting the pulse width modulator at IC4 pin 10. Q9 collector going to 12V also switches on Q10 which holds the base of Q9 low thereby preventing re-activation of the power source until it has been reset by being switched off and on again.

Q10's collector going to ov also switches on Q8 which connects +10V to the anode of the warning LED (on front panel) via P3-7 hence illuminating it, ie. PL3. permanently.

Overvolts Circuit

The 36V secondary winding of auxiliary transformer CTR1 is full wave rectified by D23 to D26. This voltage is applied to OP4 which provides an over/under voltage window whose outputs are normally sitting at 0 volts. If the voltage supplied by CTR1 goes above or below its pre-determined limits (over or under voltage detects) one of the outputs of OP4 will go high (+12V).

This applies +12V to IC9 pins 4 or 5 making the output on pin 6 go to 0 volts which in turn will change IC7 pin 4 to +12V thereby inhibiting the PWM.

Voltage/Fault Light

IC9 pin 6 going low, courses IC3 pin 5 to go high resulting in pin 4 going low thereby switching on Q8 which will illuminate the fault indicator PL3, C27 will then gradually discharge via R110 until it reaches the threshold level if IC3 pin 6. When this level is reached IC3 pin 4 will then return to +12V thereby switching off the fault indicator. However C27 will then charge up again via R110 which will cause the indicator to illuminate again. This function will repeat at a frequency determined by the values of C27 & R110 (approx 1 sec) causing the fault light to flash.

Inductance Control

This control is only in circuit in the MIG mode of operation and then only once the arc has been established. This control is by-passed when a pulse unit is fitted.

M.I.G. Mode prior to arc strike

P3-2 is at Ov therefore Q1 is off and STD is high STDB is low, the bilateral switch contacts IC15 pins 10 & 11 are open. Also at this time BYP is low resulting in IC16 pin 11 being high switching on bilateral switch IC15 contacts 8 & 9 thus by-passing the inductance control.

At Current Detect

BYP switches high switching IC16 pin 11 low thus opening bilateral switch contacts 8 & 9. The variable inductance control is now in circuit and operates as explained in the CV Output Control section.

Pulse Unit Connected

A link is now connected between P5-2 & P5-4 this ensures that BY2 is always low therefore IC16 pin 11 is always high switching on the bilateral switch contacts 8 & 9 thus by-passing the variable inductance control.