

MICRO PLASMA WELDING POWER SOURCE

PLASMAFIX 51

OPERATING SAFETY AND MAINTENANCE MANUAL

DEVICE N°W000315658



EDITION : EN
REVISION : C
DATE : 11-2008

Instructions for use

REF : **8695 9050**
DS : 415-20

Thank for the trust you have expressed by purchasing this equipment, which will give you full satisfaction if you follow its instructions for use and maintenance.

Its design, component specifications and workmanship comply with applicable European directives.

Please refer to the enclosed CE declaration to identify the directives applicable to it.

The manufacturer will not be held responsible where items not recommended by themselves are associated with this product.

For your safety,there follows a non-restrictive list of recommendations or requirements, many of which appear in the employment code.

Finally we would ask you kindly to inform your supplier of any error which you may find in this instruction manual.

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INFORMATIONS

DISPLAYS AND PRESSURE GAUGES

The measuring devices or displays for voltage, current, speed, pressure, etc., whether analog or digital, should be considered as indicators

REVISIONS

REVISION B

05/07

DESIGNATION	PAGE
Complete update	

REVISION C

11/08

DESIGNATION	PAGE
Complete update + spareparts newoffer	-

A - GENERAL

The **PLASMAFIX 51** (Plasma Sécheron Technologie) is a transistorized, programmable welding current source, specific to MICRO-PLASMA (low current PLASMA welding) and TIG welding processes, in manual or automatic operation.

The welding current supplied by this power source is perfectly regulated and is not sensitive to power supply voltage variations from the mains, within a tolerance of $\pm 10\%$ of its rated value, (230-400-440 volts) as well as to variations due to a temperature increase in the windings or electronic power parts.

The characteristics, both external and dynamic, are appropriate for MICRO-PLASMA and TIG processes.

The main source delivers a current ranging from 0.08 to 50 Amperes regulated with a 100% duty cycle in MICRO-PLASMA operation and 0.8 to 30 Amperes regulated, with a 100% duty cycle in TIG operation (50 Amperes at 60 %).

An auxiliary source destined for pilot arc in MICRO-PLASMA delivers a current of 2 or 5 Amperes at $\pm 10\%$ with a 100% duty cycle.

The power source pass-band is:

3.5 Kilo-Hertz in rectangular signals

10 Kilo-Hertz in triangular signals with distortion

The welding current is adjustable in two ranges:

from 80 mA to 5 A in steps of 20 mA

from 0.8 A to 50 A in steps of 0.2 A

A 16-bit microcontroller manages the **PLASMAFIX 51** entirely; the man/machine interface is carried out via the front panel which has keys and a user-friendly display-unit; it can be operated in several different languages.

Various welding cycles are programmable; with their associated parameters, they can be memorized on 100 different memories.

A serial interface enables connection of a printer or a P.C. type computer, under the WINDOWS 95/98 operating environment.

The **PLASMAFIX 51** power source comes in only a single, multi-voltage version: 230-400-440, with a network frequency of 50 or 60 Hertz.

The power source also has:

- A Water circuit for cooling the power electronics items and the welding torch
- Two gas circuits (main gas and annular gas)
- A reverse Gas circuit, on option
- A H.F. circuit to enable ignition of the pilot arc

CONVENTION

The **PLASMAFIX 51** Operating Manual is structured around the operating block diagram in the STRUCTURAL CONSTITUTION section, on page D31: Each subassembly is marked and explained in this section.

Each item in the diagram (L126), the spare parts (G78 - G82) or constituent items have the same item identification.

Xxx	X	: Letter corresponding to the Structural Constitution
	xx	section
		: Number corresponding to the item

Example: D3	Block diagram, page D31: Pilot arc source
	Diagram - page L12, top part: RESISTOR
	Structural Constitution - page D37: 2 X 25 Ω RESISTOR
	Constituent item - page H85, on the right
	Spare parts - page G78, reference W000141405

B - CONSIGNES DE SECURITE

Pour les consignes de sécurité générales se reporter au manuel spécifique
fourni avec cet équipement.

C - CHARACTERISTICS

The **PLASMAFIX 51** (Plasma Sécheron Technologie) comes in a single, multi-voltage version: 230-400-440 Volts.

Allowable frequency: 50 - 60 Hertz

OPEN-CIRCUIT PRIMARY CURRENT (PLASMAFIX 51 ONLY)

230 V - 2.6 A
400 V - 1.5 A
440 V - 1.36 A

Power drawn: 805 W ($\cos \varphi = 0.77$)

OPEN-CIRCUIT PRIMARY CURRENT (PLASMAFIX 51 + REFRIJET 51)

230 V - 4.1 A
400 V - 2.3 A
440 V - 2.1 A

Power drawn: 1012 W ($\cos \varphi = 0.63$)

PRIMARY CURRENT DRAWN FOR EACH PHASE (at maximum adjustment)

U1 (V)	I1 (A)	P1 (W)	COS φ
230	9,3	3371	0,91
400	5,35	3372	0,91
440	4,86	3370	0,91

PILOT ARC CIRCUIT

Continuous pilot arc current in PLASMA only

Auxiliary source output open-circuit voltage: 56 V ($\pm 10\%$)

Electrode/pipe-nozzle maximum open-circuit voltage (ignition help system in function): 108 V ($\pm 10\%$)

ON/OFF control on front panel (key + LED signal lamp)

Pilot arc current adjustment in two ranges via selection on front panel: 2 or 5 A (keys + LED signal lamps)

WELDING CIRCUIT

Direct current welding

Linear amplifier output open-circuit voltage: 47.4 V ($\pm 10\%$)

Maximum open-circuit voltage:

In PLASMA: electrode/part (help system for transfer when operating): 111 V ($\pm 10\%$)

In TIG: electrode/part: 106 V ($\pm 10\%$)

TIG or PLASMA process, which can be selected on front panel (keys + LED signal lamps)

Welding current adjustment:

In two ranges which can be selected on front panel: 5 or 50 A (keys + LED signal lamps)

Current adjustment either via adjustment items on front panel (key + encoder) A2 parameter, or via external adjustment (potentiometer remote control), gradient according to configuration:

0 to 50 A

0 to 100% of A2 parameter

Between two programmable limiting values

I min / I max

Regulated, vertical welding external characteristic

Regulation $\pm 1\%$

Welding current ripple on plasma arc of 50 A:
0.15 A

Response to a setting level - min./max.: 200 μ s

Pulsating welding current: Rectangular up to 1 KHZ

Trapezoidal from 1 to 3.5 KHZ

Triangular from 3.5 to 10 KHZ

(As of 3.5 KHZ, the pulsating current undergoes distortion at the min./max. level, reaching 50% at 10 KHZ)

Remote control plug or torch connector

Mode: 2 stroke, 4 stroke or spot

Control: single-trigger, 2 triggers

Automatic operation

PROGRAMMABLE PARAMETERS ON FRONT PANEL

CURRENT SETTINGS

LEVEL	RANGE	MIN.	MAX.	INCREMENT
Initial courant	5 A	0.08 A	5 A	0.02 A
	50 A	0.8 A	50 A	0.2 A
Welding	5 A	0.08 A	5 A	0.02 A
	50 A	0.8 A	50 A	0.2 A
Low pulsating current	5 A	0 %	99 %	1 %
	50 A	0 %	99 %	1%
Final current	5 A	0.08 A	5 A	0.02 A
	50 A	0.8 A	50 A	0.2 A

TIME-DELAYS

Pilot arc preflow gas	PLASMA Initial menu	5 s - 25 s	0.1 s
Pilot arc postflow gas	PLASMA Initial menu	0 s - 25 s	0.1 s
Annular preflow gas	PLASMA Initial menu	0 s - 25 s	0.1 s
Annular postflow gas	PLASMA Initial menu	0 s - 25 s	0.1 s
TIG preflow gas	TIG Initial menu	0 s - 25 s	0.1 s
TIG postflow gas	TIG Initial menu	0 s - 25 s	0.1 s
Reverse preflow gas	Initial menu and configuration	0 s - 25 s	0.1 s
Reverse postflow gas	Initial menu and configuration	0 s - 25 s	0.1 s
Pre-welding	S1 key and spot or 2-stroke mode	0 s - 25 s	0.1 s
Current build-up gradient	S2 key	0 s - 25 s	0.1 s
Slope-out 1 time	S4 key	0 s - 99.9 s	0.1 s
Slope-out 2 time	S5 key	0 s - 99.9 s	0.1 s
Post-welding	S6 key and spot or 2-stroke mode	0 s - 25 s	0.1 s

(Time-delay adjustment is carried out by pressing the corresponding key and variation via the encoder on the front panel)

SPOT WELDING

Time adjustable from 0.1 s to 99.9 s in steps of 0.1 s

PULSATING SETTING

Range 1 frequency:

from 1 HZ to 9.9 HZ

steps of 0.1 HZ

from 10 to 99 HZ

steps of 1 HZ

Range 2 frequency:

from 100 HZ to 1000 HZ

steps of 10 HZ

from 1000 HZ to 9900 HZ

steps of 100 HZ

Adjustable duty cycle from 10 to 90 % in steps of 10%

IGNITION HIGH-VOLTAGE POWER SOURCE

High-voltage pulse: 3 KV

Frequency: 2 to 4 MHZ

EXTERNAL CHARACTERISTICS

PLASMA welding current is adjustable in two ranges:
0.08 to 5 A and 0.8 to 50 A for a welding voltage of
15 to 30 Volts

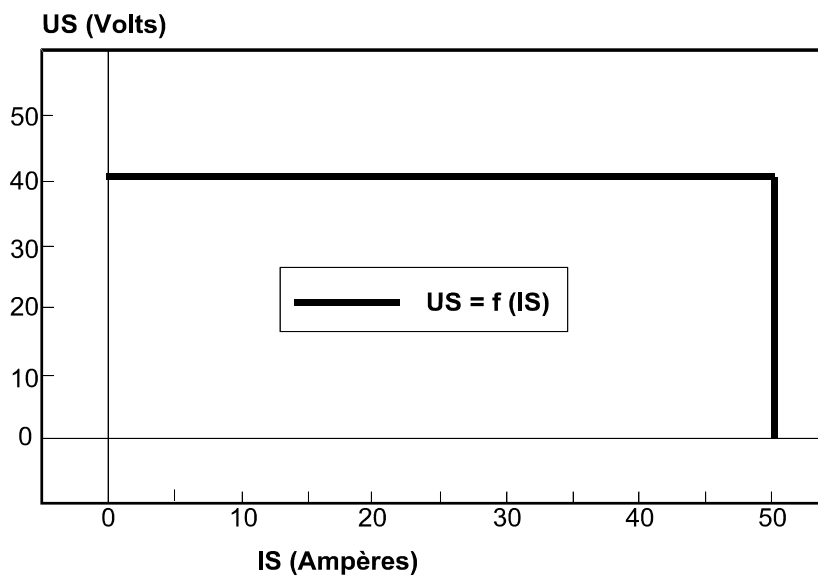
TIG welding current is adjustable in one range
0.8 to 50 A for a welding voltage of 10 to 25 Volts

The welding current is perfectly regulated for primary supply voltage variations from the power source of $\pm 10\%$ of its rated value, as well as for ambient temperature variations between 0 and 40 degrees Celsius, or for all normal temperature increases of the windings, the power parts and internal circuits.

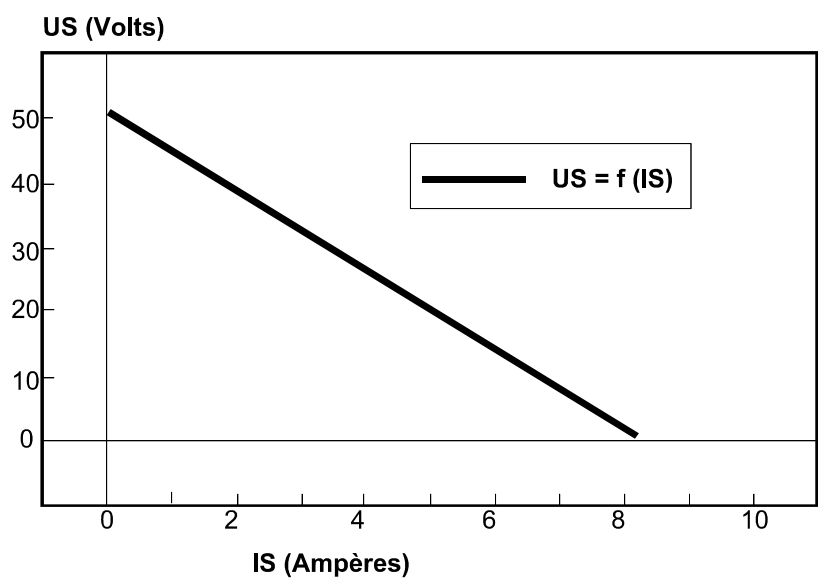
The external characteristic, welding $U = f(\text{welding } I)$ of the main source is perfectly vertical: this implies that one has little welding current variation for a decrease or increase in the PLASMA or TIG arc length.

For use at a distance, the maximum current depends on the selection of the type of control in the configuration menu
0 to 50 A - 0 to 100% of A2 - I Min to I Max

PLASMA OR TIG POWER SOURCE



PILOT ARC SOURCE



SAFETY FEATURES

Water pressure on torch reversal (30 mbars or, on option, water flow on torch reversal $d < 2.1$ l/min.)

I max., linear amplifier > 58 A

Temperature > 65 °C of linear amplifier

Arc voltage < 8 V (TIG mode)

INSULATION: class B

DEGREE OF PROTECTION: IP 23

WEIGHT: 95 KG

SIZE (in mm)

Height	:	750
Width	:	360
Depth	:	650 + 60 behind

SOUND LEVEL (for information purposes)**PLASMAFIX 51**: 50 dB(A)**PLASMAFIX 51 + REFRIJET 51**: 57 dB(A)

PLASMA welding 50 A / 26 V smooth: 63 dB(A)

PLASMA welding 50 A / 26 V pulsating 10 HZ: 67 dB(A)

PLASMA welding 50 A 26 V pulsating 1000 Hz: 71 dB(A)

PLASMA welding 50 A 26 V pulsating 10 KHZ: 78 dB(A)

SERIAL LINK

Type	RS 232
Speed	1200 Bauds
Data	8 Bits
Stop	1 Bit
Parity	None

D - STRUCTURAL CONSTITUTION

GENERAL DESCRIPTION OF THE **PLASMAFIX 51**

The **PLASMAFIX 51** power source is a compact current source which includes all the power and control elements as well as the various fluid circuits.

Welding cycle programming as well as the various adjustments are included on the front panel of the power source.

Various keys, a parameter modification encoder and an alphanumeric display-unit provide the operator with a simple and easy way to work.

The controls and selections carried out before welding are effected via keys with LED signal lamps.

Connection of the welding torch is carried out via a trap located on the right side panel (the torch harness exits via the front panel).

On the rear panel, the power source includes all the electric and fluid connections (Cooling water and Gas).

The power part (Linear amplifier type) and the welding torch are water-cooled.

A plug located on the front panel enables dialogue with the external control equipment items (automatic operation).

The pilot arc ignition high-frequency operates only during the arc ignition phase (little disturbance).

In order not to clog up the water circuit, and thus not reduce the efficiency of the power source, it is highly recommended that the **REFRIJET 51** cooling system be used.

In the following pages, the structural constitution block diagram is commented on in detail.

The power source has been "divided" up into subassembly blocks for each functionality.

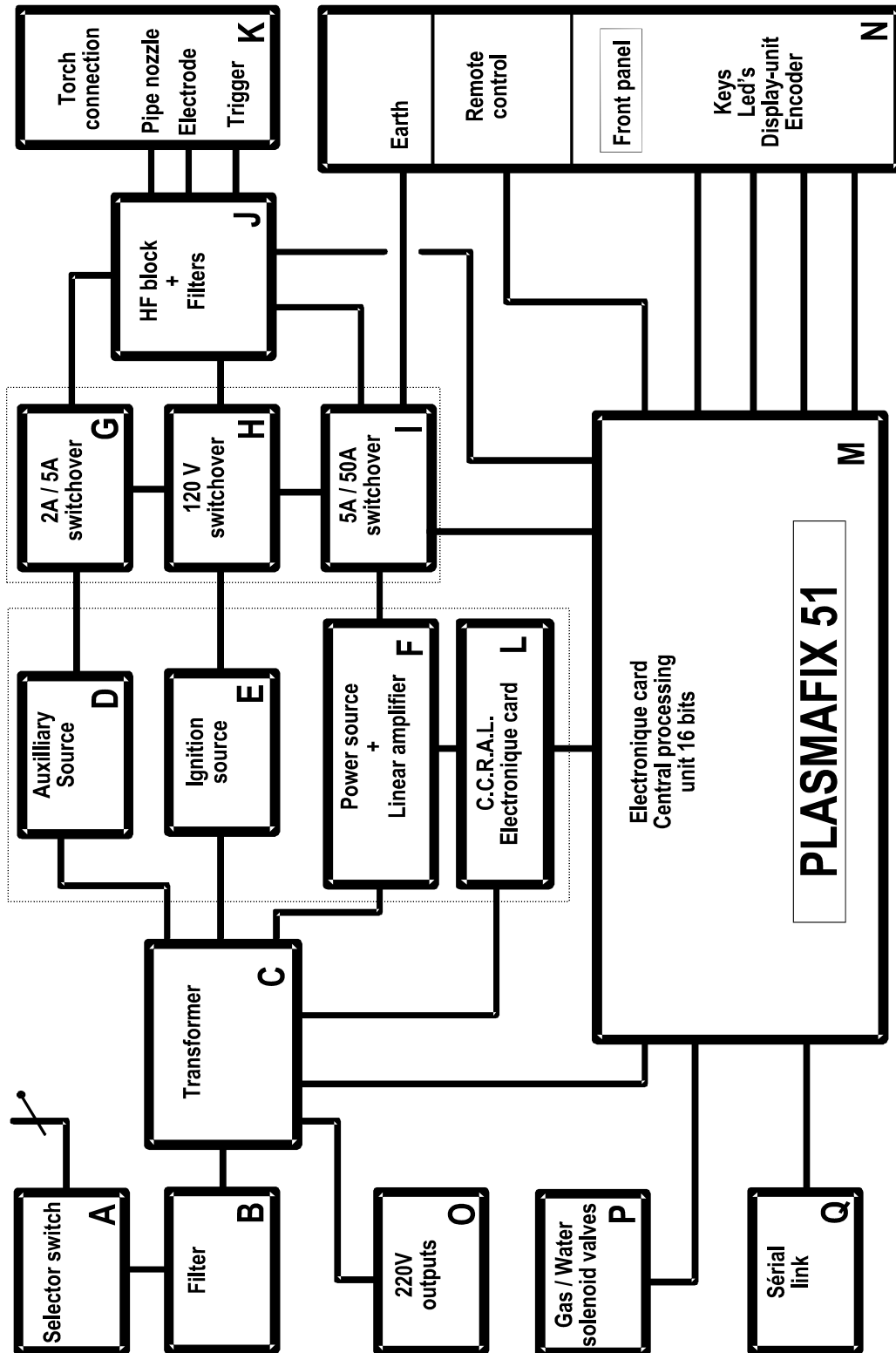
Each subassembly comprising the **PLASMAFIX 51** is identified by a letter from A to Q.

The "Spare Parts List" and "Description" sections include the same letters in order to facilitate identification of items which are out of order or defective.

The **PLASMAFIX 51** (Plasma Sécheron Technologies) is a static current source of the linear amplifier type (bipolar transistors).

Its power circuit is comprised of:

- A A startup Selector-switch
- B A three-phase Filter (compliance with EMC standards)
- C A transformer supplying the power, the electronic cards and the auxiliaries
- F A power source and 50A Linear amplifier assembly comprised of a three-phase diode bridge, filtering capacitors, a linear amplifier power module
- I A switching circuit for the main source
5/50 A)
- J A high-frequency circuit assembly - used for ignition of the pilot arc in PLASMA, or arc transfer in TIG and HF filter
- L An electronic control, command and regulation card for the linear amplifier



PLASMAFIX 51 BLOCK DIAGRAM

Its pilot arc circuit is comprised of:

- D An auxiliary source circuit comprised of a three-phase diode bridge, decoupling capacitors, resistors
(Transformer C supplies the power)
- G A 2/5 A switching circuit

An ignition circuit enables transfer of the pilot arcs and power; it is comprised of:

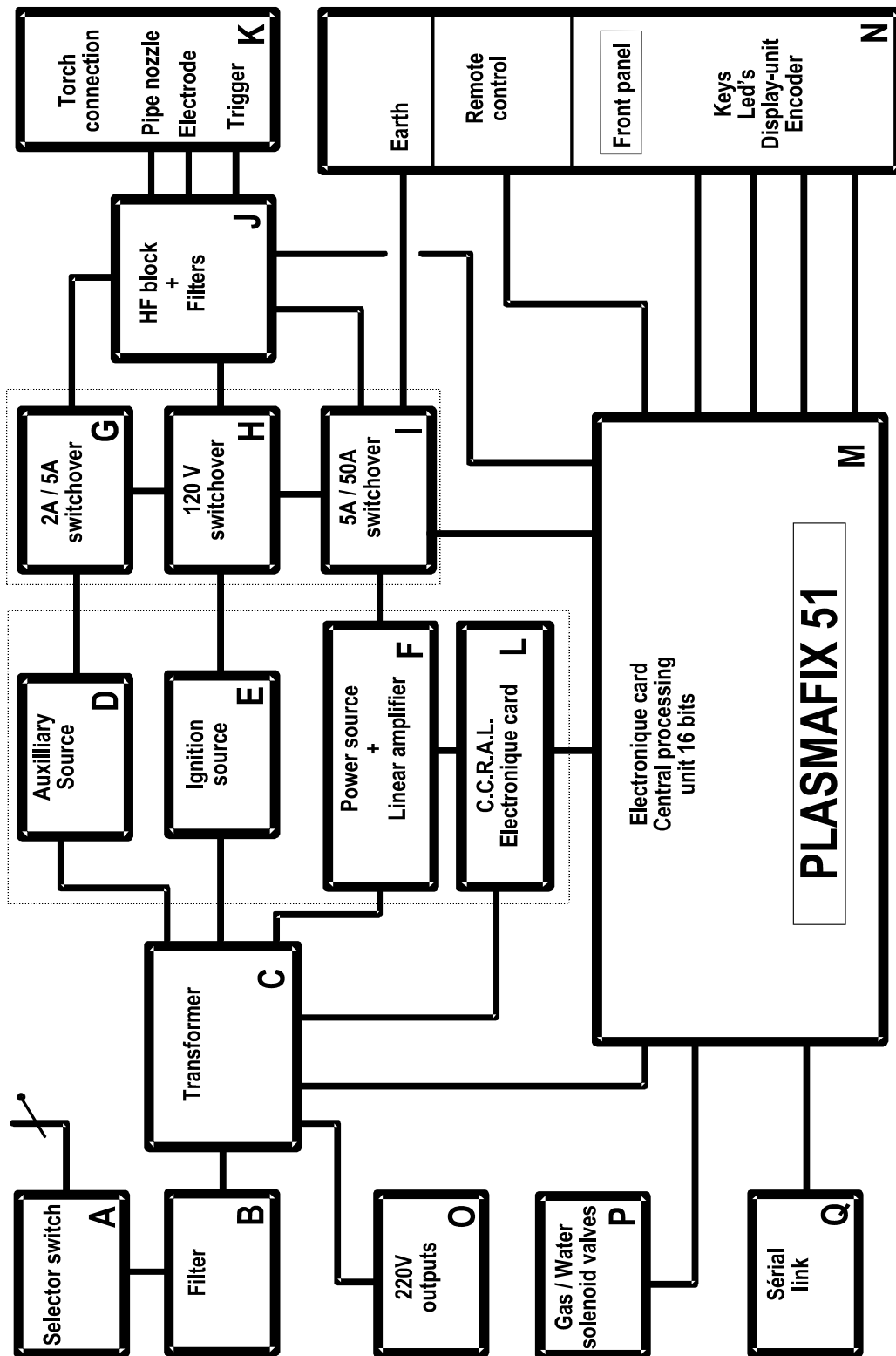
- E An ignition source circuit comprised of a three-phase diode bridge, decoupling capacitors, resistors
(Transformer C supplies the power)
- H A 106 V switching circuit

Power connection

- K The torch connection is located behind the front panel (accessible via the right side panel)
- N The workpiece connection is located on the lower part of the front panel

Rear panel

- O 220 V 6A output for power supply of the REFRIJET 51 and printer
(protection through differential)
- P Gas and Water solenoid valves, Water Safety devices are located on the rear panel
- Q RS 232 serial link plug for connection of a printer or a PC-type microcomputer



PLASMAFIX 51 BLOCK-DIAGRAM

CENTRAL PROCESSING UNIT CARD

- M Card for managing cycles, the power source, auxiliaries and the front panel

FRONT PANEL CARD

- N Front panel card ensuring interface with user

A - ON / OFF SELECTOR-SWITCH (A1 - A2)

This selector-switch ensures startup and stopping of the **PLASMAFIX 51** and of the cooling unit (if the latter is connected and operating)

The selector-switch is three-phase, 1/4 turn type

An A2 signal lamp indicates the startup of the **PLASMAFIX 51**

The LED N47 (green) indicates power source Ready

Conditions: M1 central processing unit card = OK
No safety device activated

Caution: In case of servicing operations performed in the power source, it is strongly recommended that the mains plug be disconnected before any work.

The A3 mains connection, the filter and isolating-switch are accessible via the left side panel

B - FILTER (B1)

This three-phase filter is comprised of capacitors; its purpose is to make the **PLASMAFIX 51** conform with the standard: ELECTROMAGNETIC COMPATIBILITY

This filter is active only in pulsating welding current as of a 2 KHZ frequency.

C - TRANSFORMER (C1)

This transformer is three-phase, its primary is coupled in:

230 V : Triangle Coupling
400 V and 440 V : Star Coupling

The coupled power secondary is in star configuration; its open circuit voltage is 32 V between phases.

A three-phase secondary coupled in star configuration enables the pilot arc circuit to be supplied; its open circuit voltage is 41 V between phases.

A three-phase secondary coupled in star configuration enables supply of the ignition circuit (of the pilot arc or the power arc transfer); its open circuit voltage is 75 V between phases.

Two 0 - 127 V windings mounted in series enable the cooling unit and printer to be supplied.

A 24 V single-phase secondary enables supply of all power relays (C1 to C5), solenoid valves (S1 to S3), signal lamp (A2).

A 24 V single-phase secondary enables the ignition High-frequency to be supplied.

Four low-voltage windings (2 x 0-10V and 2 x 0 - 18V) enables production of the continuous voltages necessary for the central processing unit card

Four low-voltage windings (0-18V) enable the linear amplifier control and regulation card to produce two symmetrical power supplies

A low-voltage winding (0-10V) enables the power supply to be produced for the front panel card.

Protection of transformer windings

Voltage	Fuse	Rating	Name
0 - 24	C2 & C3	10A	All auxiliaries (except HF and Water solenoid valve)
127	C4	6A	1/2 220V winding (Printer and REFRIJET)
0 - 18	C5 & C6	2A	Central Processing Unit Card (15V supply settings input)
0 - 18	C7 & C8	2A	Central Processing Unit Card (15V power supply optocoupler input)
0 - 10	C9 & C10	2A	Central Processing Unit Card (5V power supply Serial link)
3 x 75	C11, C12 & C13	2 A	Ignition source (Three-phase)
0 - 24	C14 & C15	6 A	24 V signal lamp (front panel) and Water solenoid valve
127	C16	6A	220V 1/2 winding (Printer and REFRIJET)
0 - 18	C17 & C18	2A	CCRAL card (+15V power supply LEM)
0 - 18	C19 & C20	2A	CCRAL card (-15V power supply LEM)
0 - 10	C21 & C22	6A	Central Processing Unit Card (5V power supply)
3 x 41	C23, C24 & C25	6A	Auxiliary source (Three-phase)
0 - 24	C26 & C27	6 A	High frequency
127	C28	6A	Device
0 - 18	C29 & C30	2A	CCRAL card (+15V power supply regulation)
0 - 18	C31 & C32	2A	CCRAL card (-15V power supply regulation)
0 - 10	C33 & C34	2A	Front panel card (- 5V power supply display-unit)
3 x 32	Not protected		Power winding

D - AUXILIARY SOURCE (D1 - D5)

The auxiliary source supplies the energy necessary for the pilot arc in PLASMA operation.

From the transformer windings, the D1 three-phase diode bridge supplies a continuous voltage. This bridge is the 25 A molded type; it is mounted on the linear amplifier radiator.

The D2 and D3 resistors are mounted in series with the pilot arc in order to limit the pilot arc current to:

2 A D3 resistor (2x25 Ω)

5 A D3 resistor in // with D2 (4x25 Ω)

All the resistors are mounted on the linear amplifier radiator.

In 2 A operation, the welding cycle enables arc ignition at 5 A.

Diode D4 blocks the main source current when both sources are mounted in parallel. This diode is a molded module placed on the linear amplifier radiator.

A D5 capacitor filters the voltage at the diode bridge output

E - IGNITION SOURCE (E1 - E4)

The ignition source has two functions:

- It enables pilot arc transfer with a voltage of 106 V.
- As soon as the pilot arc is ignited, the ignition source is connected in parallel to the main source in order to facilitate the PLASMA transfer

From the transformer windings, the E1 three-phase diode bridge supplies a continuous voltage. This bridge is the 10 A molded type; it is mounted on the linear amplifier radiator.

Resistors E2 and E3 are used to limit the ignition source current: E2 for the auxiliary source, E3 for the main source

All the resistors are mounted on the linear amplifier radiator.

Capacitor E4 filters the voltage at the diode bridge output.

During welding, this source remains operative: the power source minimum current is 80 mA.

F - POWER SOURCE, LINEAR AMPLIFIER (F1 - F9)

The main source supplies the energy necessary for PLASMA arc or TIG arc.

From the transformer windings, the F1 three-phase diode bridge supplies a continuous voltage. This bridge is the 100 A molded type; it is mounted on the linear amplifier radiator.

This diode bridge is oversized in order to authorize the inrush current upon powering up, due to the charge of the F2 filtering capacitor.

Capacitor F2 ensures filtering of direct current supplying the linear amplifier; its role is to smooth the current from the rectifier bridge in order to minimize the output current ripple (On 50 A plasma arc, the residual ripple is on the order of 0.1 A) and to act as a buffer for all inrush currents due to pulsating currents

Resistor F3 discharges capacitor F2 when the **PLASMAFIX 51** is powered down.

Linear amplifier F4 is comprised of 20 bipolar transistors (with high pass-band) controlled by 2 driver transistors which are managed by the CCRAL card (L1). These 20 transistors are mounted in parallel through a current balancing resistor for each of them.

These resistors enable one to give the foldback current of each transistor which, after going through a diode network, provide the CCRAL card (L1) with information; the latter processes it for the central processing unit card (M1)

The current maximum that the linear amplifier can deliver is 58 A.

Beyond this limit, the CCRAL card blocks the control of the transistors and gives the information to the central processing unit card:

The N52 front panel LED informs the operator of the fault

The transistors are mounted on a copper radiator which is water-cooled. The water comes from the cooling system which is also used to cool the torch.

Flow-switch P16 anticipates a lack of flow in the water circuit which would result in abnormal heating up of the transistors. It supplies the information to the central processing unit card (M1).

The N51 front panel LED informs the operator of the fault

A thermal protection (F9) with 75°C rating is mounted on the water circuit (at the level of the radiator) in order to give the "temperature overrun" information to the central processing unit card (M1)

The N50 front panel LED informs the operator of the fault

Two measuring shunts, F5 and F6, are an integral part of the linear amplifier assembly: These shunts give the foldback current to the CCRAL card (L1).

Depending on the choice of current scale (5 or 50 A) used, a switchover (I1/I2) enables one to select the shunt giving maximum accuracy:

F5 50 A shunt - 60 mV readout - accuracy: 0.5 %

F6 5 A shunt - 60 mV readout - accuracy: 0.5 %

Two diodes, F7 and F8, placed on the main current have a 100 A rating (F7) for the 50 A range and 10 A rating (F8) for the 5 A range; they are mounted on a heat-sink. Their role is to block the auxiliary current source for help with the transfer mounted in parallel on the power source Each diode is in series with the shunt corresponding to the range before switchover (I1/I2).

G - SWITCHOVER OF PILOT ARC SOURCE (G1, G2)

These relays ensure the choice of the pilot arc rating in PLASMA welding.

G1 relay: Choice of 2 / 5 A rating (G1=1: 5A rating)

G2 relay: Authorization of startup of the pilot arc auxiliary source

These relays are controlled from the front panel information (N22 pilot arc key and keys with 2A N21, 5A N20 rating) and from the welding cycle.

The relay coils are controlled from central processing unit card M1 via the 24 V power supply (C2 & C3).

H - SWITCHOVER OF THE IGNITION SOURCE (H1)

The H1 relay ensures switchover of the ignition source between the pilot arc auxiliary source and the transfer source in PLASMA.

This relay is controlled from the welding cycle; its coil is controlled from central processing unit card M1 via the 24 V power supply (C2 & C3).

I - SWITCHOVER OF THE POWER SOURCE (I1 – I2)

These relays ensure the choice of the power source rating in PLASMA welding (In TIG, only the 50 A rating is activated).

I1 contactor: Authorization of startup of the 50 A power source in TIG and PLASMA

I2 relay: Authorization of startup of the 5 A power source in PLASMA and switching over of the ignition source either to the 5 A or 50 A power source

This relay and contactor is controlled from the front panel information (N18 50 A rating key, N24 5A rating key and N19 TIG key) and from the welding cycle.

The relay coils are controlled from central processing unit card M1 via the 24 V power supply (C2 & C3).

J - FILTERS AND HIGH-FREQUENCY BLOCK (J1 – J16)

The high frequency enables the pilot arc ignition in PLASMA and arc ignition in TIG welding (if the choice is selected in the - HF TIG or PAC TIG program).

The filters, set out at various places in the wiring, protect the control electronics from possible High-frequency reversals.

High frequency J2, associated with its High Voltage transformer J4, is the SERIAL type (HF circuit closing is effected by capacitor J5).

The operation frequency is on the order of 2 to 4 MHZ.

The high voltage which enables the ignition (dielectric breakdown between the electrode and the pipe-nozzle in PLASMA and between the electrode and the part in HF TIG) is on the order of 5 KV.

Relay J1 controls the high frequency using the information of central processing unit card M1 and 2 timmers J13-J4 ; its coil is supplied in 24 V (C2 & C3).

The HF block supply is insulated 24 V (C26 & C27).

Filter j3 and J5 protects the linear amplifier from HF reversals.

Filter J6-J7-J8 and J9 protects the trigger controls from HF reversals.

Filter J12 protects the auxiliary source from HF reversals .

Filter J11 protects HF supply .

Ferrite cores are placed on various ribbon cables, trigger, Auxiliary source to improve the insensitivity rate of the **PLASMAFIX 51**

K - TORCH CONNECTION ASSEMBLY (K1 - K6)

Connection of the MICRO PLASMA **SP45** welding torch is carried out via a trap located on the right side panel.

Packing gland K6, with protection of the torch harness, is placed in the front panel.

The K3 trigger connector is placed in the torch compartment.

Torch compartment:

K	Power	Control	Gas	Water	Color
K1 Green	Pilot arc - PIPE- NOZZLE			To Torch	Green
K2 Red	Power - ELECTRODE		Central		Red
K3		Trigger			
K4 Blue	Power (not connected)			To N51	Blue
K5 Yellow			Annular		Yellow

L - CCRAL ELECTRONIC CARD (L1) (Linear Amplifier Regulation and Control Card)

This card is the interface between central processing unit card M1 and the power electronics of linear amplifier F4.

This card ensures:

- **Analog regulation** of the welding current (using the information from Measuring shunts (F5 or F6) and the setting given by central processing unit card M1)
This regulation is automatically adaptable, depending on the process (TIG or PLASMA), the PLASMA rating (5 or 50 A), and the arc voltage
- Protection of the linear amplifier
 - Current lower than 58 A
 - Arc voltage higher than 10 V
 - Temperature at level of power transistors less than 70 °C (F9)
- The voltage insulated measurement and welding current (5 and 50 A ratings) for display in front panel (N35) of parameters during welding, and for current process control and voltage

- The pilot arc source voltage relay, the power source current relay, in order to give the information to the central processing unit card for the welding cycle

This card is placed in the power electronics compartment, fastened to the linear amplifier.

This card has two double insulated power supplies (C17 to C20, C29 to C32)

Adjustments:

P3	- 15 V power supply
P4	+ 15 V power supply
P1	I _{maxi} protection adjustment (1.1V)
P6	Adjustment of 5 A range min. (30 mA during welding)
P5	Adjustment of 50 A range min. (0.3A during welding)
P2	Adjustment of 50 A range maxi. (50 A during welding)

M - CENTRAL PROCESSING UNIT CARD (M1 - M2)

This card is the very core of the **PLASMAFIX 51**

This card is built around a 16-bit microcontroller (INTEL).

The internal frequency is 8 MHZ.

The EPROM resident program size is approximately 50 Kbytes

The maximum backup size for the programs is 64 Kbytes
(RAM stored for 10 Years).

An integrated clock enables display of the time parameters during printouts or on the front panel display-unit.

Each input or output group is completely insulated by an optocoupler.

Role of the central processing unit card:

- Management of the linear amplifier
 - Pulsating setting at 10 Khz
 - Management of safety features
 - Readout of I and U measurements
 - Management of current and voltage relays

- Management of auxiliaries
 - Contacteur and relay
 - Solenoid valve
 - High frequency

- Memorization of 100 programs with:
 - 36 PLASMA parameters or
 - 34 TIG parameters
 - 20 Configuration parameters
(for each program)

- Management of 10 different welding cycles
 - PLASMA
 - TIG
 - 1 trigger / 2 trigger / Spot
 - Manuel / Automatic

- Management of front panel
 - L.C.D display-unit (N35)
 - Modification encoder (N1)
 - Function keys (32)
 - LED (33)

- Management of remote control
 - Four 0/1 inputs
 - One analog input
 - Five 0/1 outputs

- Management of serial link
 - Printout of parameters
 - Dialogue with PC

List of inputs

Function	Connector	Item	Power supply
Initial trigger	J10-2	K3/N16	C7-C8
Final trigger	J10-3	K3/N16	C7-C8
External gas bleed-off	J10-4	N16	C7-C8
Thermal protection	J10-5	F9	C7-C8
Water safety device	J10-6	P14	C7-C8
Remote control presence	J10-8	N16	C7-C8
Front panel encoder	J3	N1	C21-C22
Front panel keys	J3	N	C21-C22
Remote controls	J6-2	N16	C5-C60
RS232 link (input)	J4-2	Q1	C9-C10
Arc U measurement	J7-9	L1	C29 to C32
5 A I measurement	J7-7	L1	C29 to C32
50 A I measurement	J7-8	L1	C29 to C32

Internal inputs

The central processing unit card has 2 groups of 8 miniature switches

Switch 1 (Microcontroller proximity)

1	ON	Name =PLASMAFIX 51
2	OFF	
3	OFF ON	Normal Erase the RAM memory
4	OFF ON	Short-circuit detection in TIG mode No detection
5		Not used
6		Not used
7		Not used
8	OFF ON	Normal Reset UC

Switch 2 (optical range proximity)

1 à 8	Reserved for check and adjustment on factory
-------	--

List of outputs

Functions	Connector	Item	Power supply
Front panel LED's	J3	N	C21-C22
LCD display-units	J3	N35	C21-C22
Welding setting	J7-5	L1	C17 to C20
RS232 link (Output)	J4-1	Q1	C9-C10
Pulsating information (internal)	J11-2	M1	C21-C22
5/50A information	J7-4	L1	C17 to C20
Main gas solenoid valve	J5-2	P2	C2-C3
Annular gas solenoid valve	J5-1	P1	C2-C3
HF control	J5-3	J1	C2-C3
5 A rating relay	J5-4	I2	C2-C3
ignition relays	J5-5	H1	C2-C3
5 A SA relay	J5-6	G1	C2-C3
SA relays	J5-7	G2	C2-C3
50 A contactor	J5-8	I1	C2-C3
External solenoid valve	J9-11	P3	C2-C3
Buzzer	J8-3/4	M2	C2-C3
Process control	J8-5/6	N16	
Current relay	J9-1/2	N16	
SA voltage relay	J9-3/4	N16	
Wire authorization	J9-7/8	N16	
Movement authorization	J9-5/6	N16	

No adjustment is to be carried out on the central processing unit card

Buzzer M2 sounds whenever the keys are pressed, as well as the elapsed time alarm.

N - FRONT PANEL (N1 - N68)

The front panel enables programming of the **PLASMAFIX 51**.

It is comprised of:

An alphanumeric LCD display-unit with 2 lines of 20 characters each, displaying plain-text messages in the various languages used

Keys enabling access to the programming functions

An encoder for modifying the current parameter

Status and process display LED's

A blocking key for keyboard adjustments

PLASMA gas flowrate adjustments and, optionally, Reverse

A plug for the power source remote control

An On/Off selector-switch

A packing gland for passage of the **SP45** torch

The earth connection

The following two views show the referenced items attached to the functions. These referenced items correspond to the general diagram.

Each pictogram is then detailed and commented on.

Note

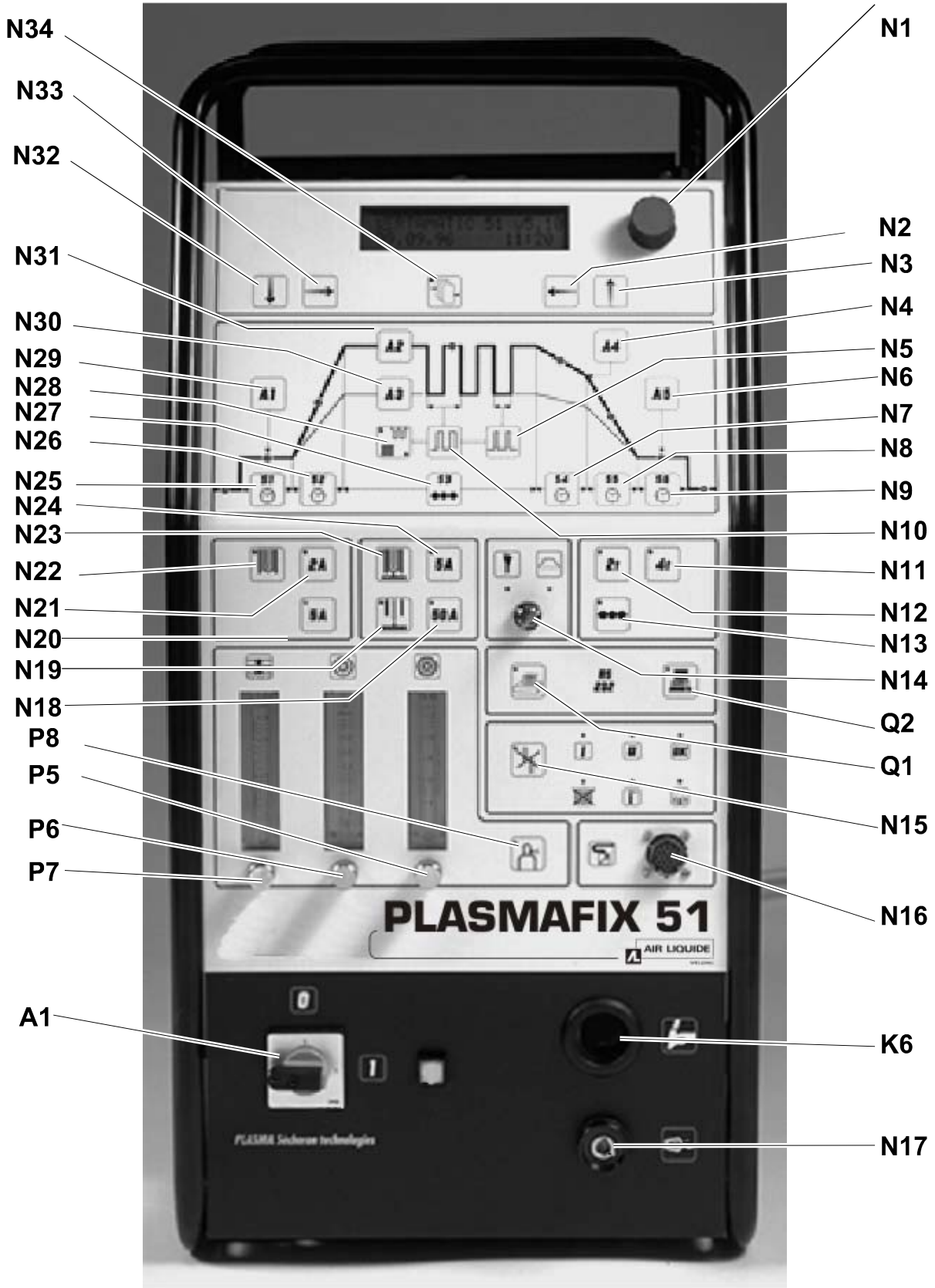
The front panel is comprised of 3 subassemblies:

The bare front panel (Sheet metal and LEXAN): N66

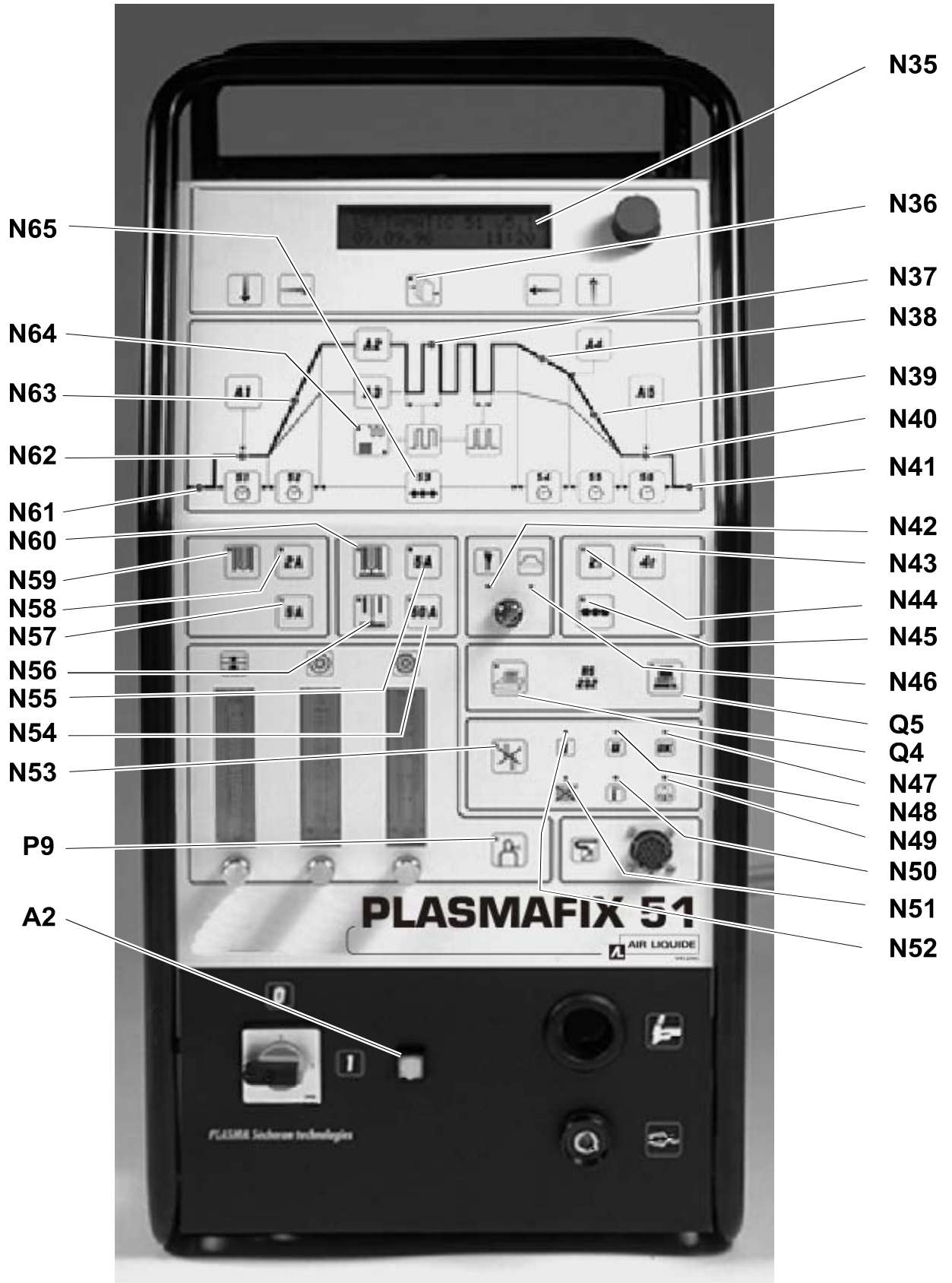
The top keyboard card: N67









The bottom keyboard card: N68





PLASMAFIX 51 KEYS













NERTAMATIC51 DISPLAY











Pictogram	Key Mark.	Display mark.	Functions
	N1		Variation of current parameter Modification of value in plus or minus After pressing on a key A (current), S (time-delays), F (frequencies) the encoder enables one to modify the value corresponding to the key pressed
	N2		Key for changing parameter or line in the pull-down menu status (on the left) The selection pointer is materialized by a star *, this key changes the place of the star
	N3		Pull-down menu key (negative) to return to the previous status (or previous menu)
	N4		Current level adjustment key between slope-out 1 and 2 Encoder N1 modifies the value (steps of 0.2 or 0.02 A) Level A4 is independent of the other levels (e.g.: A4 > A2) If A4 = A2: Slope-out 1 is not active If A4 = A5: Slope-out 2 is not active In both cases, the S4 and S5 times are active
	N5		Duty cycle adjustment key (when pulsating operation is activated, LED N64 or N65 = 1) Encoder N1 modifies the value (steps of 10%)
	N6	N40 Jaune	Post-welding level adjustment key Level A5 is independent of the other levels (e.g.: A5 > A2) Encoder N1 modifies the value (steps of 0.2 or 0.02 A) If A5 = A4: Slope-out 2 is not active
	N7	N38 Jaune	Slope-out 1 time adjustment key Encoder N1 modifies the value (steps of 0.1 S) If S4 = 0: Slope-out 1 is not active
	N8	N39 Jaune	Slope-out 2 time adjustment key Encoder N1 modifies the value (steps of 0.1 S) If S5 = 0: Slope-out 2 is not active




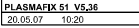


Pictogram	Key Mark.	Display mark.	Functions								
	N10		<p>Pulsating frequency adjustment key This key, active in pulsating mode (N64 or N65 = 1), enables frequency adjustment</p> <p>Depending on the frequency value, encoder N1 gives different steps:</p> <table> <tr> <td>1 to 10 Hz</td> <td>steps of 0.1 Hz</td> </tr> <tr> <td>10 to 100 Hz</td> <td>steps of 1 Hz</td> </tr> <tr> <td>100 to 1000 Hz</td> <td>steps of 10 Hz</td> </tr> <tr> <td>1 to 10 KHz</td> <td>steps of 100 Hz</td> </tr> </table>	1 to 10 Hz	steps of 0.1 Hz	10 to 100 Hz	steps of 1 Hz	100 to 1000 Hz	steps of 10 Hz	1 to 10 KHz	steps of 100 Hz
1 to 10 Hz	steps of 0.1 Hz										
10 to 100 Hz	steps of 1 Hz										
100 to 1000 Hz	steps of 10 Hz										
1 to 10 KHz	steps of 100 Hz										
	N11	N43 Verte	<p>Selection of 4-stroke mode This mode can be used in manual or automatic TIG or PLASMA</p> <p>In this mode, the S1, S3, S6 keys have no function</p> <p>In automatic mode, transient control operation is activated</p> <p>LED N43 displays the status</p> <p>See Appendix N°2: Welding cycles</p>								
	N12	N44 Verte	<p>Selection of 2-stroke mode This mode can be used in manual or automatic TIG or PLASMA</p> <p>In this mode, the S3 key is non-operational In automatic mode, continuous control operation is activated</p> <p>LED N44 displays the status</p> <p>See Appendix N°2: Welding cycles</p>								
	N13	N45 Verte	<p>Selection of spot mode This mode can be used in TIG or PLASMA, only in manual.</p> <p>In this mode, the S3 key is activated At the end of the S3 time-delay, the slope-out is carried out automatically without action of the triggers</p> <p>LED N45 displays the status</p> <p>See Appendix N°2: Welding cycles</p>								





Pictogram	Key Mark.	Display mark.	Functions
	N14	N42 N46 Jaune	<p>Front panel blocking key This key enables one to block all the front panel keys: Whenever a parameter key is pressed or a pull-down menu selection is made, this enables display of the status but does not enable modification of the parameter</p> <p>Use with a remote control becomes mandatory in order to be able to vary the welding current according to the ranges defined by the A2 parameters</p> <p>LED N42 displays blocking of the front panel LED N46 displays the status of the PLASMAFIX 51, ready to be programmed</p>
	N15	N53 Verte	<p>SAFETY Validation Key When a safety device becomes active, the PLASMAFIX 51 stops its welding cycle, the LED corresponding to the safety device = 1</p> <p>To divide the welding cycle up, it is necessary to validate the safety features via N15, N53 = 1:</p> <ul style="list-style-type: none"> - If the safety device is no longer active, the corresponding safety LED goes off - If N53 and the safety LED remain activated, it is necessary to check the circuits, the operating temperature, the water and contact the ALW after-sales department if necessary
	N16		<p>Remote control plug This plug enables one to control the PLASMAFIX 51 externally</p> <p>In manual operation, the remote control (potentiometer or pedal) is connected</p> <p>In automatic operation, the PLASMAFIX 51 is controlled by a mechanization machine which supplies the welding setting, the welding pulses</p> <p>In return, the power source supplies the following information:</p> <ul style="list-style-type: none"> Current relay Pilot arc voltage relay Movement control Filler wire control Process control information
	N17		<p>Earth connection Connection via DINSE plug of the workpiece (+ polarity)</p>











Pictogram	Key Mark.	Display mark.	Functions
	N18	N54 Verte	<p>Selection of current rating in PLASMA The current rating is 50 A (it is memorized in the program) The minimum current is 0.6 A; the adjustment step is 0.2 A</p> <p>LED N54 is active</p> <p>In TIG, this key is non-operational</p>
	N19	N56 Jaune	<p>Choice of TIG process</p> <p>N56 indicates the choice</p> <p>In TIG, the current is adjustable on the 50 A rating</p>
	N20	N57 Verte	<p>Choice of pilot arc rating in PLASMA This key configures the auxiliary source in order to have a pilot arc current of 5A</p> <p>LED N57 displays the choice</p> <p>In TIG, this key is non-operational</p>
	N21	N58 Verte	<p>Choice of pilot arc rating in PLASMA This key configures the auxiliary source to have a pilot arc current of 2A</p> <p>Upon ignition, the cycle switches the auxiliary source to 5 A in order to ensure the pilot arc output</p> <p>LED N58 displays the choice</p> <p>In TIG, this key is non-operational</p>
	N22	N59 Jaune	<p>Startup of the pilot arc This key initiates the ignition cycle of the pilot arc in PLASMA pressing once: Startup pressing twice: Stopping</p> <p>N59 indicates that the pilot arc is established (RI function)</p> <p>In case of interruption of the pilot arc, N59 = 0; the cycle is started up again</p> <p>In TIG, this key is non-operational</p>
	N23	N60 Jaune	<p>Choice of PLASMA process</p> <p>N60 indicates the choice</p>


Pictogram	Key Mark.	Display mark.	Functions
	N24	N55 Verte	<p>Selection of current rating in PLASMA The current rating is 5 A (it is memorized in the program) The minimum current is 0.06 A, the adjustment step is 0.02 A</p> <p>LED N55 is active</p> <p>In TIG, this key is non-operational</p>
	N25		<p>Pre-welding time adjustment key in 2-stroke mode Encoder N1 modifies the value (steps of 0.1 S) If S6 = 0: The pre-welding is not active</p> <p>In 4-stroke mode this parameter cannot be selected</p>
	N26	N63 Jaune	<p>Current build- up time adjustment key Encoder N1 modifies the value (steps of 0.1 S)</p> <p>If S2 = 0: switching between the A1 pre-welding and the A2 welding levels is carried out abruptly</p>
	N27		<p>Spot time adjustment key This key is active only if the N45 spot selection is operating Encoder N1 modifies the value (steps of 0.1 S)</p> <p>In 2-stroke and 4-stroke mode, this key is not active</p>
	N28	N64 Verte N65 Verte	<p>Selection of pulsating mode This key can be pressed several times:</p> <p>Initial: Smooth current N64 = N65 = 0 Second: Frequency rating pulsating operation (1 to 99 Hz) N64 = 1 Third: Frequency rating pulsating operation (100 to 10000 Hz) N65 = 1</p>
	N29	N62 Jaune	<p>Pre-welding level adjustment key Level A1 is independent of the other levels (e.g.: A1 > A2)</p> <p>Encoder N1 modifies the value (steps of 0.2 or 0.02 A)</p> <p>If A1 = A2: The current slope is not active</p>

Pictogram	Key Mark.	Display mark.	Functions
	N30		<p>Low level adjustment key in pulsating current</p> <p>This key enables one to adjust, in percentage of the A2 parameter, the low level in pulsating use. When operating with a remote control, it becomes dependent on the remote control adjustment.</p> <p>The A2 parameter, slightly adjusted, may result in arc interruptions</p> <p>This key is non-operational in smooth current mode (N64 and N65 = 0)</p> <p>Encoder N1 modifies the value (steps of 0.2 or 0.02 A)</p>
	N31	N37 Jaune	<p>Current level adjustment key</p> <p>Depending on the type of remote control selected in the configuration menu, the A2 parameter can be pressed several times</p> <p>0/100% mode: pressed once only The welding current is a percentage of A2 depending on the position of the remote control</p> <p>Imin/Imax mode Initial: No modification possible Pressing once: Modification of minimum current corresponding to position 0 of the remote control Pressing a second time: Modification of the maximum current corresponding to the maximum position of the Remote control The remote control enables one to have a welding current between Imin and Imax</p> <p>0/50A mode: The A2 parameter cannot be selected The remote control adjusts the current (depending on the rating: 0.08A - 5A or 0.8A - 50A)</p> <p>A2 is the only parameter which can be modified at startup of the PLASMAFIX 51 or at the end of a welding cycle As soon as another key is pressed, the corresponding parameter becomes modifiable</p> <p>Encoder N1 modifies the value (steps of 0.2 or 0.02 A)</p>

Pictogram	Key Mark.	Display mark.	Functions
	N32		Pull-down menu key (positive) to access the next status (or next menu)
	N33		Key for changing parameter or line in the pull-down menu status (on the right) The selection pointer is materialized by a star *, this key changes the place of the star
	N34	N36 Verte	Program call-up or memorization key This key has two functions: In programming mode, it enables one to call up one program out of 100 which can be selected The called-up program becomes the active program In memorization mode, it enables one to save, in a program number, the present status of the active program (current) (e.g.: Backup after a modification of a called-up program) A blank program can be identified by lines instead of current values.
		N35	LCD alphanumeric display-unit This display-unit has 2 lines of 20 characters each The current parameter choice is carried out via the keys. The possible modification is materialized by a star * Adjustment on the N66 keyboard card enables one to adjust the contrast of the display-unit See Appendix N°1 for the list of messages available in French.
 Post gaz		N41 Jaune	Postflow gas sequence display LED Continuous LED: PLASMA or TIG annular postflow gas Flashing LED: PLASMA PILOT ARC postflow gas
		N47 Verte	PLASMAFIX 51 READY: When the power source is turned on, the central processing unit performs a self-test: if the test is O.K., LED N47 is activated If N47 = 0: Contact the ALW After-Sales Department

		<p>N48 Rouge</p>	<p>Activation of Voltage information:</p> <p>Continuous LED: SAFETY - Arc voltage less than 8 V In PAC system TIG, the safety device is not active upon arc ignition</p> <p>Safety validation via N15</p> <p>Flashing LED: PROCESS CONTROL - +/- overrun of the value programmed in the process control menu</p>
		<p>N49 Rouge</p>	<p>Alarm</p> <p>Flashing LED in case of overrun of welding time or the maximum number of programmed ignitions (if the ARC CONTROL option is validated in the configuration menu)</p> <p>This LED operates jointly with the M2 Buzzer (Buzzer sounds)</p> <p>Safety validation via N15 or modification in the configuration menu</p>
		<p>N50 Rouge</p>	<p>Power electronics temperature SAFETY higher than 70 °C</p> <p>This safety device can be activated in normal operation if the duty cycle in TIG welding is exceeded (Maximum = 60 %)</p> <p>Safety validation via N15</p>
		<p>N51 Rouge</p>	<p>Abnormal water pressure SAFETY</p> <p>Safety validation via N15</p>

Pictogram	Key Mark.	Display mark.	Functions
		N52 Rouge	Activation of Current information: Continuous LED: SAFETY - Current greater than 58 A Safety validation via N15 Flashing LED: PROCESS CONTROL +/- overrun of the value programmed in the process control menu
 Pré-gaz		N61 Orange	Preflow gas sequence display LED Continuous LED: PLASMA or TIG annular preflow gas Flashing LED: PLASMA PILOT ARC preflow gas
	A1		On/Off selector-switch Vertical position = 0 Horizontal position = 1
		A2	Power source Signal lamp when PLASMAFIX 51 operating = 1 (green)
		K6	Packing gland for passage of SP45 torch Connection in torch compartment
	P5		PLASMA annular gas or TIG gas circuit Adjustment of gas flowrate = 2 - 12 L/min.
	P6		Main gas circuit in PLASMA (Pilot arc) Adjustment of gas flowrate = 0.1 - 0.8 L/min.
	P7		Reverse gas circuit (OPTION) Adjustment of gas flowrate = 2 - 12 L/min. In case of non-use, a cover is mounted.
	P8	P9 Verte	Gas bleed-off key - each time this key is pressed, it is memorized and corresponds to 1 second (pressing 10 times in succession = 10 S) LED P9 indicates the overall all gas bleed-off time
	Q1	Q4 Verte	Printout key This key enables one to initiate a printout Outside welding, if a serial printer is connected: Q2 Key (LED Q4) is not active If Q2 (LED Q4) is active, this key validates the backup of the current program to a microcomputer operating under the PLASMAFIX 51 WINDOWS environment

Pictogram	Key Mark.	Display mark.	Functions
			Note: During welding: Printout of welding I and U if the WELDING PRINT option is validated in the configuration menu (printout frequency is adjustable) LED Q4 is active each time it is pushed during loading of the printer buffer
	Q2	Q5 Verte	Microcomputer dialogue key This key enables one to select the backup mode of the current program when the PLASMAFIX 51 is connected to a microcomputer In this mode, LED Q5 is active See the PLASMAFIX 51 parameter memorization software instructions

The keyboard is comprised of a complete front panel in LEXAN, white at the top part and black at the bottom.

The front panel can be removed via the front for troubleshooting.

Two printed circuits are mounted behind the front panel:

N66: Top keyboard card
This card has a power supply used to back-light the LCD display-unit as well as contrast of the segments. a potentiometer enables one to adjust the contrast of the LCD display-unit (accessible after removing the top panel).
Each key and LED can be removed individually.

N67: Bottom keyboard card
This card supports the rest of the keys and LED; it is connected electrically to the top keyboard card.

Adjustment of gas flowrates is carried out via a round button on the flowmeters (fine-adjustment step for central gas [P6]).

O - 230 V POWER SUPPLY (O1 - O4)

This power supply is necessary for the **REFRIJET 51** cooling unit and for use with a printer.

From the main transformer, the 127 V C2 / C4 and C14 / C16 windings are mounted in series.

Quick-trip circuit-breaker O3 on the rear panel ensures protection of the operators.

Plug O1 supplies the cooling unit: It is of the 3-pin type (earth) and is insulated (60 - 230 standard).

Plug O2 of the same type supplies an external printer (Maximum current: 0.5 A).

The rear panel print is as follows:



Fan O4 is placed on the rear panel in order to move an air current inside the **PLASMAFIX 51**.

It is supplied in 230 V.

P - FLUID (P1 - P17)

Welding torch **SP 45** as well as the power electronics of the **PLASMAFIX 51** require WATER cooling.

The water circuit is comprised of:



P12 A water inlet coupling (green)

P4 A water solenoid valve (permanently supplied - powering the **PLASMAFIX 51** down enables one to carry out servicing operations on the water circuit (Replacement of torch, draining)

K4 The torch outlet connection (Blue)

K1 The torch reverse connection (Green)

P15 A pressure switch controlling the passage of water in torch reversal + Linear amplifier, (threshold at 30 mBars)
Pressure switch adjustable in case of using with > 4 m torch harnesse.



P13 The water backflow connection (red)

The main gas circuit (Pilot arc) is comprised of:



P11 A gas inlet connection
It is absolutely essential that the service pressure be 3 Bars. A double-expansion pressure regulator is necessary in order to ensure the precision of the pilot arc flowrate

P2 Main gas solenoid valve
(24 V power supply - High-quality manufactured item - stainless steel body)

P6 Main gas flowmeter
Adjustment from 0.1 L/min. to 0.8 L/min.

K2 Connection to **SP 45** torch (Red)

The annular gas circuit is comprised of:



P10 A gas inlet connection
It is absolutely essential that the service pressure be 3 Bars; a single-expansion pressure regulator is necessary

P1 Annular gas solenoid valve
(24 V power supply)

P5 Annular gas flowmeter
Adjustment from 2 L/min. to 12 L/min.

K5 Connection to **SP 45** torch (Yellow)

The reverse gas circuit (option) is comprised of:



P16 A gas inlet connection
It is absolutely essential that the service pressure be 3 Bars; a single-expansion pressure regulator is necessary

P3 Reverse gas solenoid valve
(24 V power supply)

P7 Reverse gas flowmeter
Adjustment from 2 L/min. to 12 L/min.



P17 Connection to welding set

Key P8 enables one to bleed-off the gas: This key is of the transient type, but it is memorized by the central processing unit card

Pressing it once corresponds to 1s
(pressing it 10 times = 10 S)

Q - Serial link plug (Q1 - Q5)

The RS232 type serial link enables:

Printout of current program parameters outside welding

Printout of arc voltage and current during welding if the WELDING PRINT option is validated in the configuration menu

Dialogue with a PC type microcomputer with especially-designed ALW software which enables:

Programs to be written off-site

Programs to be loaded

Saving of the **PLASMAFIX 51** memory on the PC.

This software operates in the WINDOWS 95/98 environment

Key Q1 associated with LED Q4 enables one to launch the printout of the current program parameters, provided that key Q2 is not active (Q5 LED = 0).

Should Key Q2 be active, the printer gives us an ASCII message corresponding to the serial communication with the **PLASMAFIX 51** software

See Appendix 3, Communication Protocol.

Key Q2, associated with LED Q5, is used with the **PLASMAFIX 51** software. To save the current program, Key Q2 is active; pressing Key Q1 launches the backup.

To enter a program, one has only to run the **PLASMAFIX 51** software in transmission and to memorize the new resident program in a memory via the MEMO key.

Plug Q3, of the RS 232 - 25-pin type, is located on the rear panel



E - CONNECTING THE PLASMAFIX 51

1 - PRIMARY POWER SUPPLY

THE POWER SOURCE PRIMARY PROTECTION DEVICES ARE NOT INCLUDED IN OUR SUPPLY SINCE THEY ARE SPECIFIC TO THE POWER SUPPLY NETWORKS AND MUST BE INSTALLED IN A FIXED STATION IN A WALL CABINET.

In order for the connection of the power source to comply with applicable decrees and regulations, it is the user's responsibility to supply the **PLASMAFIX 51** through means of contactors, electromagnetic relays or isolating switches with an appropriate rating in accordance with the user's network voltage.

For automatic machines, **ALW** proposes a power supply cabinet satisfying applicable standards, reference W000315438.

PRIMARY CURRENT DRAWN BY EACH PHASE (at maximum adjustment)

U1 (V)	I1 (A)	P1 (W)	COS φ
230	9.3	3371	0.91
400	5.35	3372	0.91
440	4.86	3370	0.91

The power supply circuit of these contactors must run via one (or more) emergency shutdown button(s), enabling one to open them in case of necessity.

2 - CONNECTION TO THE MAINS

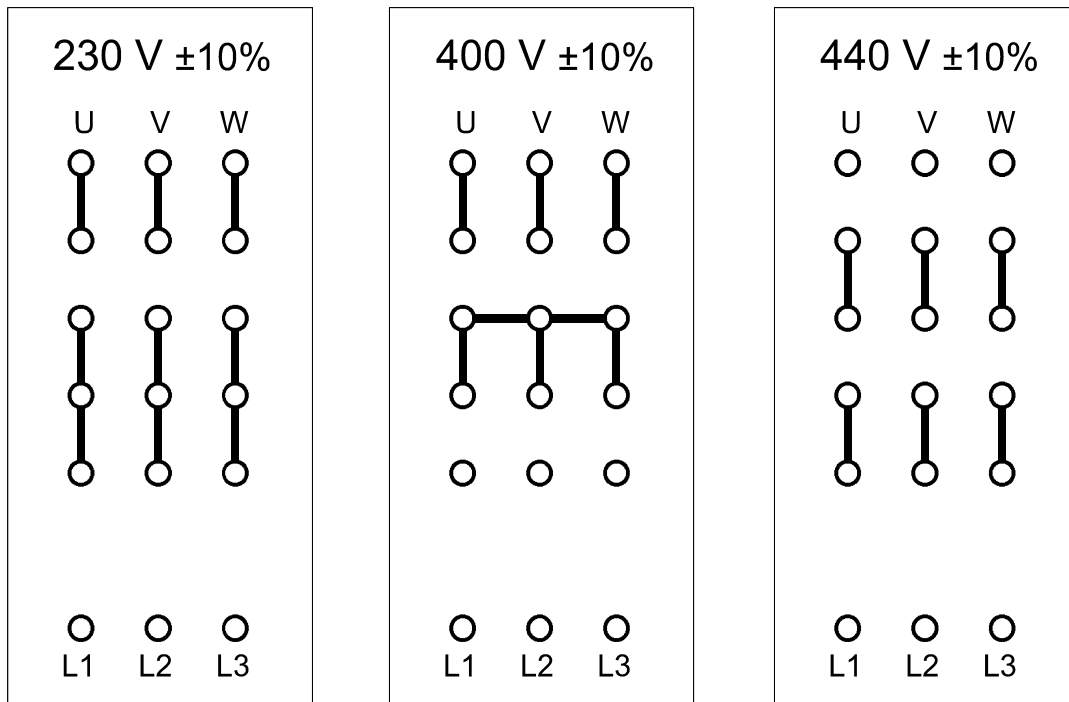
The **PLASMAFIX 51** power source is delivered "ready-to-use":

It has a power supply cable (four 2.5 mm² conductors) with a length of 5 meters, connected directly to the primary terminals

This cable is delivered bare (connection via a plug or a cut-out device).

Never omit the earth connection

The power supply and primary coupling terminals are accessible after removing the left side panel.



The power source is delivered for a 400 V power supply voltage

For 230 V or 440 V voltages, it is necessary to position the coupling strips according to the information given on the terminal holder plate (near *the coupling plates*).

3 - CONNECTION OF THE WELDING CIRCUIT

The **PLASMAFIX 51** power source has 3 output terminals for the welding circuit:

Earth terminal	Polarity (+) on front panel via the "DINSE" N17 plug
Electrode (torch)	Polarity (-) on the argon/electricity central gas connection (red) Accessible via the door of the left side panel (Item K2)
Pipe-nozzle (torch)	Polarity (+) on the torch/electricity water backflow connection (green) Accessible via the door of the left side panel (Item K1)

The **SP45** manual torch is connected by means of 4 couplings (olive-fitting/nut):

- Central gas	: Red item	K2
- Annular gas	: Yellow item	K5
- Water outlet	: Green item	K1
- Water backflow	: Blue item	K4

and via the K3 trigger connector

The **SP45** automatic torch is connected the same way as the **SP45** manual torch except for the trigger connector which does not exist
Automatic controls are carried out via the N16 plug.

Before connecting these torches, it is first necessary to have "run" the harness through the K6 front panel packing gland.

It is absolutely essential to comply with the colors between the torch connections and the power source connections

4 - CONNECTION OF CONTROL CIRCUITS

In the manual version, control is carried out only via the double trigger of the manual **SP45** torch.

In the automatic version, dialogue is carried out via the N16 plug located on the front panel:

A - B	Trigger presence	Strap	Input
A - C	Initial trigger	Contact	Input
A - D	Final trigger	Contact	Input
A - E	Immediately stop	Contact	Input
F - G	Main source current relay	24 V = or ~ 1A	Output
H - J	Pilot arc source voltage relay	24 V = or ~ 1A	Output
K - L	Movement information	24 V = or ~ 1A	Output
U - V	Process control	24 V = or ~ 1A	Output
P	Shielding	Setting	
R	10 V power supply for Remote Control	0 - 10 V or potentiometer	Output
S	Remote Control cursor or setting	potentiometer	Input
T	Remote control 0V (Remote Control)	1 K Ω	

Note: Do not connect the remote control 0 V to the earth

5 - CONNECTION OF FLUID CIRCUITS

The Water and Gas circuits are incorporated in the power source:

The gas inlets and water inlet/outlet (from the cooling unit) are positioned on the rear panel.

The gas outlets and torch water inlets/outlets are located inside the power source on the left side, accessible via a door located on the left panel (towards the front).

Main gas circuit:

Gas inlet: Via hose on rear side
maximum pressure = 3 Bars

P11



Gas outlet: Via K2 red torch connection

Annular gas circuit:

Gas inlet: Via hose on rear side

P10



Gas outlet: Via K5 yellow torch connection

Water circuit:

The cooling unit is external to the power source

Cold water input: Via connection on rear panel P12
 (green)

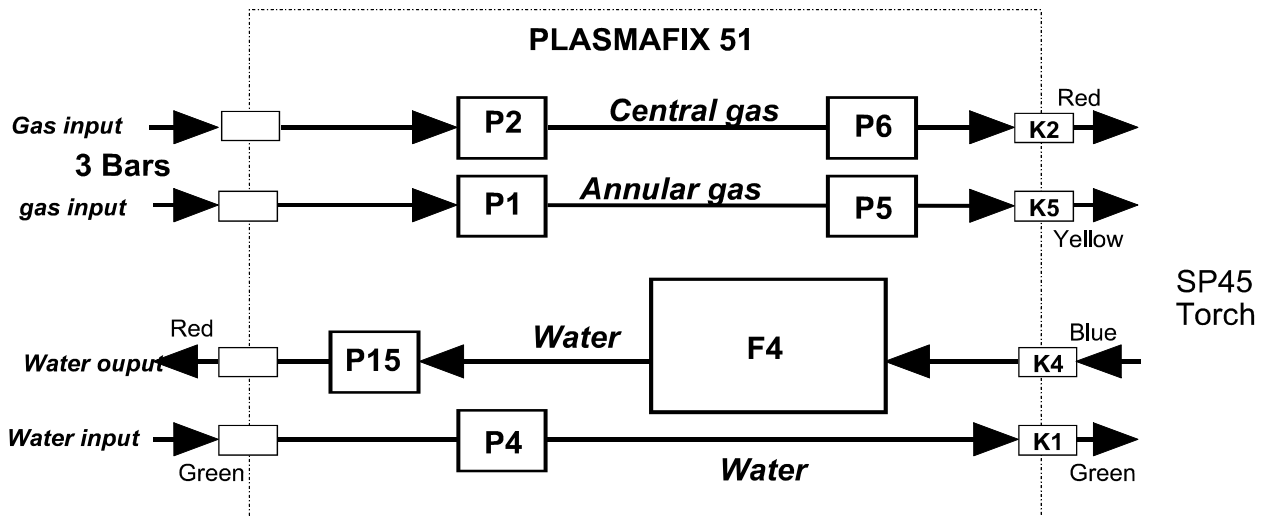


Hot water outlet: Via connection on rear panel P13
 (red)



Water outlet to torch: Via K1 green torch connection

Torch water backflow: Via K4 blue torch connection

FLUID circuit

- P1 Annular gas solenoid valve
- P2 Central gas solenoid valve
- P4 Water solenoid valve
- P5 Annular gas flowmeter
- P6 Central gas flowmeter
- P15 Outlet pressure controller
- F4 Linear amplifier
- K1 Pilot arc / water connection
- K2 Power / central gas connection
- K4 Water backflow connection
- K5 Annular gas connection

6 - ELECTRIC CONNECTION OF COOLING UNIT AND PRINTER

The cooling unit and printer power supply are connected to the **PLASMAFIX 51** by mains power supply cords, standard: 60 320.

It is connected to the O1 plug located on the rear panel:




A quick-trip circuit-breaker protects the user from possible earthing faults if, for example, the printer wire should be cut.

F - QUICK STARTUP

1) Connection of PLASMAFIX 51

1.1) Mains - Example: Mains 400 V/50 HZ 
See Page E 64

1.2) Main gas supply: 3-Bar pressure regulator (Argon) 
See Page E 68

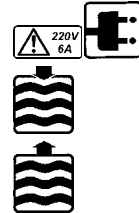
1.3) Annular gas supply: 3-Bar pressure regulator (Argon + Hydrogen) 
See Page E 68

1.4) Cooling unit connection

Electrical


Water inlet (green)

Water outlet (red)



See Pages E68 and E70

1.5) Connection of **SP45** torch

Run the torch through the front panel 

Trigger		K3
Central gas/pilot arc	Red	K2
Annular gas	Yellow	K5
Water/power lead-out	Green	K1
Water backflow	Blue	K4

1.6) Connection of workpiece

Earth connection N17
See Page E66



2) Putting the equipment into operation

2.1) Put the GAS in service (pressure regulator)
(Verification of possible leaks)

2.2) Fill the **REFRIJET 51** with the cooling liquid

2.3) Putting the **PLASMAFIX 51 into operation**

A1 selector-switch = 1 (Mains)

A2 signal lamp ⇒ 1

LED N47 ⇒ 1

N35 initial display-unit message

OK	
PLASMAFIX 51 V5.36	
20.05.07	10:20

Put N14 key in programming position

⇒ LED N46 = 1



During 30 s, water safety device N51 can be activated

(pressurizing of circuit)

Wait 2 min. and validate the safety via N15 key

⇒ LED N51 = 0



Check for possible water leaks


















Add cooling liquid to reach nominal level

The **PLASMAFIX 51** is ready to be programmed

3) **PLASMAFIX 51** configuration

To change lines: Press the corresponding key

To modify a value: Turn encoder N1

Pictogram	Key	Encoder	Status or choice
	N32		Configuration menu Diagnosis menu
		YES	Configuration menu = YES
			Message PLASMAFIX 51 CONFIGURATION
	N32	NO	Current Cntrl = NO
	N33	NO	Voltage Cntrl = NO
	N32	NO	Movement Control = NO
	N33	NO	Filler Wire Control = NO
	N32	NO	Reverse Gas Control = NO
	N33	NO	Ignition Cntrl = NO
	N32	NO	Arc Cntrl = NO
	N32	FRENCH	LANGUAGE = FRENCH
	N33	IM - Im	Remote Control = IM - Im
	N33	Average	Measurement = Average
	N32	001	Power source index = 001
	N33	NO	IN/OUT Display = NO
	N32	NO	Welding Printout = NO
	N32	%	Set date: Year/Month/Day
	N32	%	Set time: Hour/Minute/Second
	N32	YES	Welding menu = YES

4) Choice of process

N23 Key PLASMA = 1












LED N60 ⇔ 1











- 5) Choice of welding current rating
 N18 Key 50 A
 LED N51 ⇨ 1 **50A**
- 6) Choice of pilot arc rating
 N20 Key 5 A
 LED N57 ⇨ 1 **5A**
- 7) Choice of welding cycle
 N11 Key 4T
 LED N43 ⇨ 1 **4t**
- 8) Programming of welding cycle

To change lines: Press the corresponding key









To modify a value: Turn encoder N1

Pictogram	Funct.	Key	LED	encoder	Status or choice
	A1	N29	N62	5A	Pre-welding current
	S2	N26	N63	1S	Build-up time
	A2	N31	N37	15A	High current during welding
	A4	N4	N38	5A	Slope-out stage
	A5	N6	N40	2A	Post-welding current
	S4	N7	N38	1S	Slope-out 1 time
	S5	N8	N39	2S	Slope-out 2 time
	Puls	N28	N65		Choice of pulsating rating
	Freq	N10		1000Hz	Pulsating frequency
	Cycl	N5		50%	Duty cycle
	A3	N30	N37	50%	Low level current during welding

9) Adjustment of initial menu

Pictogram	Key	Encoder	Status or choice
			PLASMAFIX 51 V5.36 initial menu
	N32	8S	Program choice menu
	N33	12S	Memorization menu
	N32	0,3min (=18S)	Main preflow gas time
	N33	12S	Main postflow gas time
	N32	0.5S	Annular preflow gas time
	N33	3S	Annular postflow gas time
	N32		Configuration menu = NO Diagnosis menu = NO
	N32		PLASMAFIX 51 V5.36 initial menu

10) Memorization of program

Pictogram	Key	Encoder	Status or choice
			PLASMAFIX 51 V5.36 initial menu
	N32		Program choice menu
	N33		Memorization menu
		33	Choice of a free program, Example 33
			Memorization of adjustments of PLASMAFIX 51 in program 33 (LED 36 = 1)
	N32		Adjustment of main gas time-delays
	N32		Adjustment of annular gas time-delays
	N32		Adjustment of annular gas time-delays
	N32		Configuration menu = NO Diagnosis menu = NO
	N32		PLASMAFIX 51 V5.36 menu initial

The **PLASMAFIX 51** is ready to weld.

11) Adjustment of **SP45** torch

- Take an electrode, 1.6 mm diameter
- Adjustment of electrode using the template
- Take a 1.8 mm pipe-nozzle
- Take an 11 mm diameter nozzle

See **SP45** torch operating manual, ref: 8695 9001

12) Adjustment of gases

- Bleed the gas off by pressing key P8 10 times
(pressing once corresponds to 1 S)

Adjustment of main gas on 0.3 L/min. via P6

Adjustment of annular gas at 4 L/min. via P5



13) Ignition of pilot arc

- Pilot arc N59 key = 1
- Preflow gas LED N61 flashes for 8 s
- The pilot arc is established at 5 A
- Preflow gas LED = 0
- Pilot arc LED N59 = 1



The **PLASMAFIX 51** is ready to transfer the PLASMA arc

14) Welding

- Initial trigger = 1
- Continuous preflow gas LED N61 = 1 - For 0.5 S
- The **PLASMAFIX 51** transfers the arc under 5A in smooth current
- Preflow gas LED N61 = 0
- Pre-welding LED N62 = 1
- Initial trigger = 0
- Build-up of pulsating current for 1S
- Pre-welding LED N62 = 0
- Welding LED N37 = 1

G - SPARE PARTS LIST

Référence	QTY	ITEM			NAME	COMMENTS
0064 1051	1			U	Mains wire (l=3m)	2.5 mm ² - 3 ph+t
W000141400	1	A1	*	R	Primary selector-switch	Baco
W000141401	1	A2	*	R	Energizing signal lamp	(Lampe 24v)
W000141402	1	A2	*	U	Bulb for signal lamp, 24V	
	33	C2-C34	*	R	Transformer fuses	
	1	F9		R	Thermal protection	
9258 0620	1	A3	*	R	Terminal plate	
0389 5272	1	B1		R	EMC filter	
9258 0616		C1	*	R	Main transformer	
W000141404	1	D1		R	Auxiliary source diode bridge (Pilot arc)	To be mounted on the linear amplifier circuit
	1	D4+F8		R	Auxiliary source diode	Double casing To be mounted on the linear amplifier circuit
	1	E1		R	Ignition source diode bridge	To be mounted on the linear amplifier circuit
	1	F7		R	50A main source diode	To be mounted on the linear amplifier circuit
	1	F8+D4		R	5A main source diode	Double casing To be mounted on the linear amplifier circuit
W000141405	4	D2 D3		R	Auxiliary source resistor	24.9 Ω - 50 W To be mounted on the linear amplifier circuit
	2	E2		R	Ignition source resistor	499 Ω - 50 W To be mounted on the linear amplifier circuit
	1	E3		R	Ignition source resistor	1K Ω - 25 W To be mounted on the linear amplifier circuit
	1	F2		R	Main source filtering capacitor	
	1	I3		R	I1 contactor protection filter	To be mounted on I1
	1	F3		R	Main source resistor	1K Ω - 25 W To be mounted on the linear amplifier circuit
	1	J5		R	HF capacitor	
W000141417	1	F1		R	Main source diode bridge	To be mounted on the linear amplifier circuit
W000141399	1	F4 J1 D5 E4		R	Linear amplifier HF control relay (welded) Capacitors	Active part (CI + radiator + Transistors)
9258 0627	1	F5		R	50a 60 mv Shunt	
9258 0628	1	F6		R	5a 60 mv Shunt	
W000141406	1	G1		U	Auxiliary source relay	OMRON MK2PS 24 V ALT
	1	G2			Auxiliary source relay	
	1	H1			Ignition source relay	
	1	I2			5A main source relay	
	1	J1			HF relay	
W000141407	1	I1		U	50A main source relay	TELEMECANIQUE LC1 D254 A65
9258 0611	1	J2-J3 J4-J6		R	High-frequency block complete with trigger filter	

Référence	QTY	ITEM			NAME	COMMENTS
W000141418	1	J5		R	CI bouclage HF	
9258 0625	1	K1	*	R	Equipped torch connection plate	
	1	K2				
	1	K4				
	1	K5				
W000147151	1	K3		R	Trigger connector socket	
9258 0630	1	K6	*	R	Torch passage packing gland	
W000141396	1	L1		R	Linear amplifier adjustment and control card	CCRAL - See troubleshooting instructions for adjustment of card
W000141395	1	M1		R	Central processing unit card	
W000141403	1	M2		R	Signaling buzzer	
W000141415	1	N1		R	Encoder	To be welded on CI
9258 0645	35	N2-N34 P8-Q1- Q2		R	Keyboard keys	To be welded on CI
W000141416	1	N14		R	Selector-switch (key type)	
9258 0644	32	N36-N65 P9 Q4 Q5		R	Display LED	
W000141408	1	N16	*	R	Remote control socket + harness to Central Processing Unit	
W000147170	1	N17		R	Earth connection socket	
W000141414	1	N35		R	LCD display-unit + connector	
W000141397	1	N66		R	Equipped top keyboard card	
W000141398	1	N67		R	Equipped bottom keyboard card	
9258 0615	1	N68		R	PLASMAFIX P+E bare front panel	
W000141409	2	O1 O2	*	R	230V Socket for printer and GRE	
9258 0634	1	O3		R	Quick-trip circuit-breaker	Legrand
9258 0635	1	O4		R	Fan	Radio spares
	2	P1 P3		R O	Annular gas solenoid valve Reverse gas solenoid valve	(with connectors) (Option)
	1	P2		R	Main gas solenoid valve	(with connectors)
W000141411	1	P4		R	Water solenoid valve	6 mm passage diameter (with connector)
W000141412	2	P5 P7		R O	Annular gas flowmeter Reverse gas flowmeter	2 - 12 L/min. (with connectors) [Option]
W000141413	1	P6		R	Main gas flowmeter	0.1 - 0.8 l/mn (with connectors)
9258 0632	1	Q3	*	R	Serial link socket	With wiring
9258 0617	1		*	R	Heat-formed casing	(high-grade sheet metal)

U: WEAR AND TEAR

R: REPLACEMENT

O: OPTIONS

QTY: QUANTITY IN POWER SOURCE

***:** CONTACT SAF FOR PRICES AND DELIVERY DATES

Miscellaneous references

PLASMAFIX 51	W000315658
REFRISAF 51 cooling unit	W000315645
<i>FREEZCOOL</i> liquid	W00010167
Earthing conductor	W000315644
Argon single-stage 3-bar pressure regulator	W000290218
Ar/H2 single-stage 3-bar pressure regulator	W000290234
Argon two-stage 3-bar pressure regulator	-
Serial printer	-
Printer cable	-
Printer paper	-
PLASMAFIX 51 software	-
NULL MODEM wire for microcomputer	-
Bare trigger connector	W000270833
Bare remote control plug	W000147142
Trigger pedal	W000141369
Trigger pedal + I	W000315649
SP 45 Manual Torch	9258 0111
SP 45 Automatic Torch	9258 0112
Complete box of accessories	W000315651
Trolley 51	W000315659

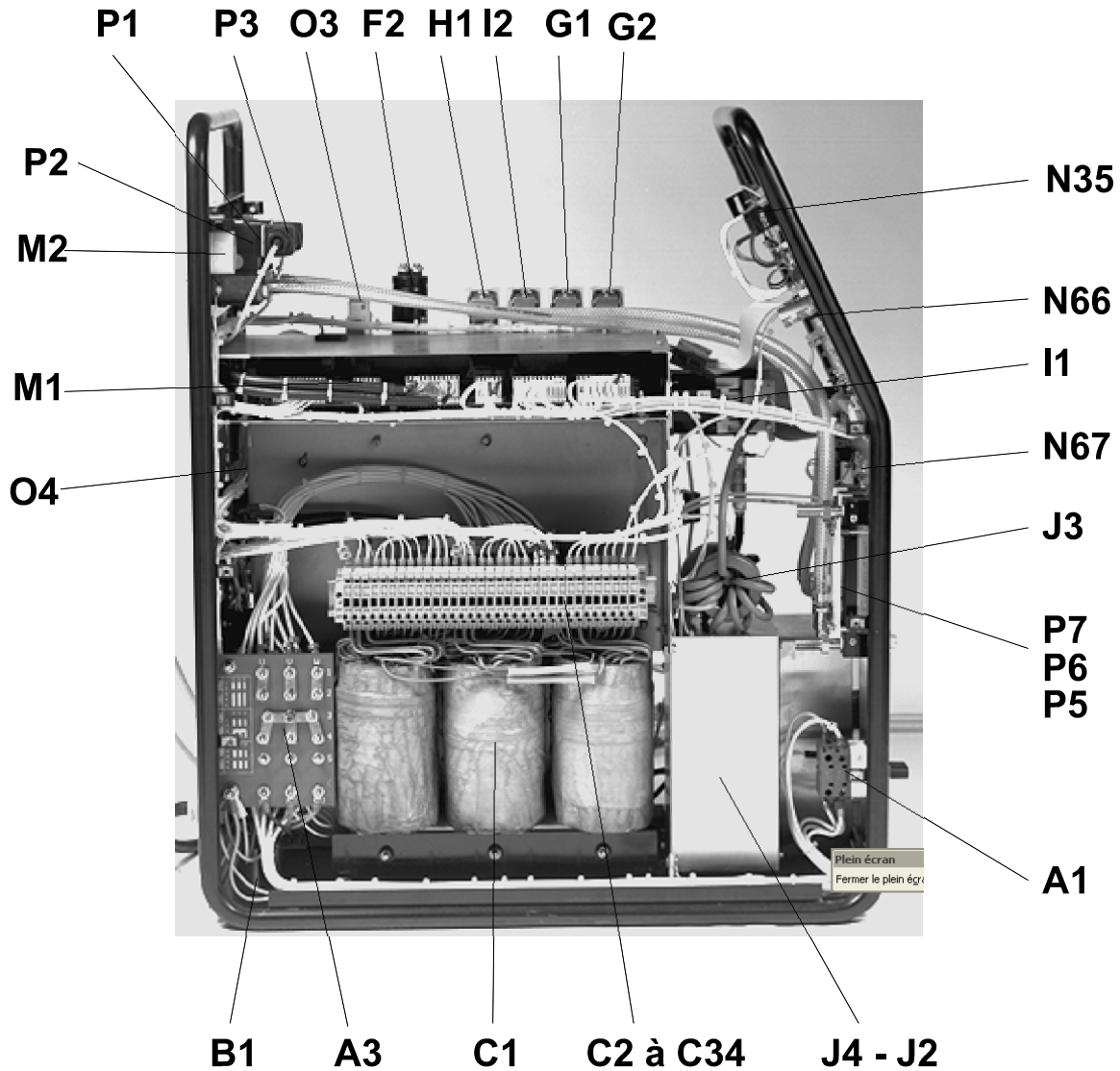
PLASMAFIX 51



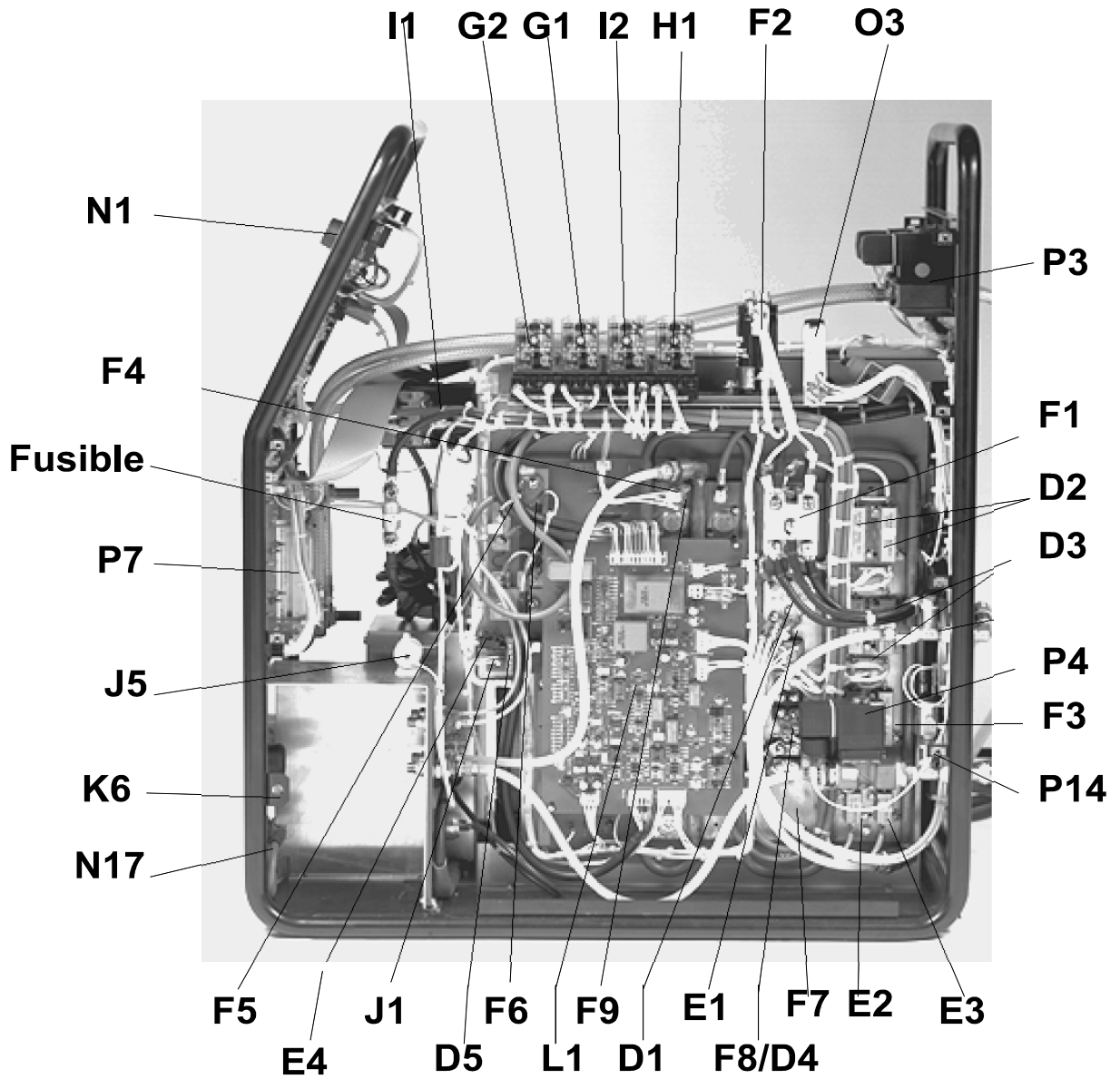
G-65

H - CONSTITUENT ITEMS

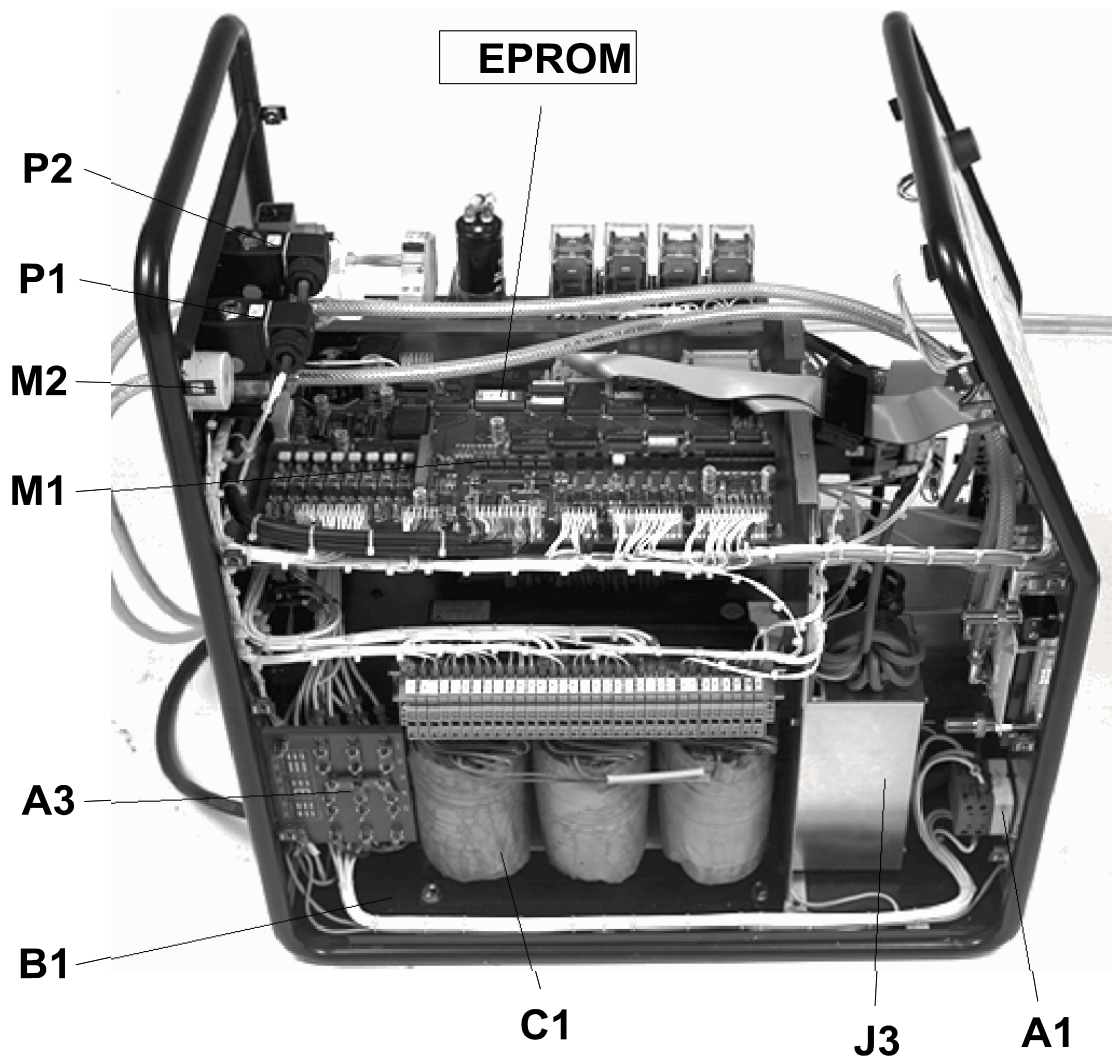
View from left side



View from right side



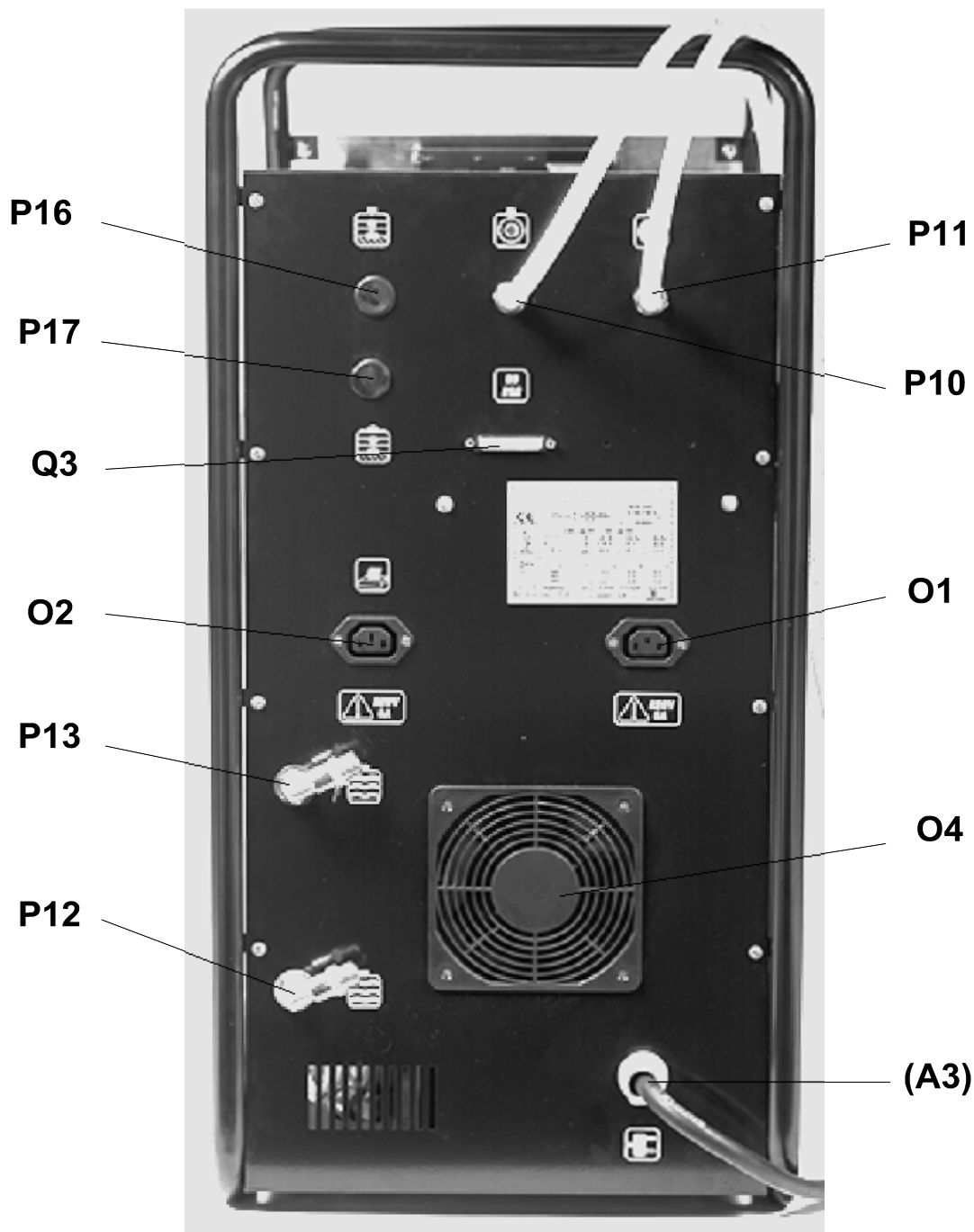
View from top



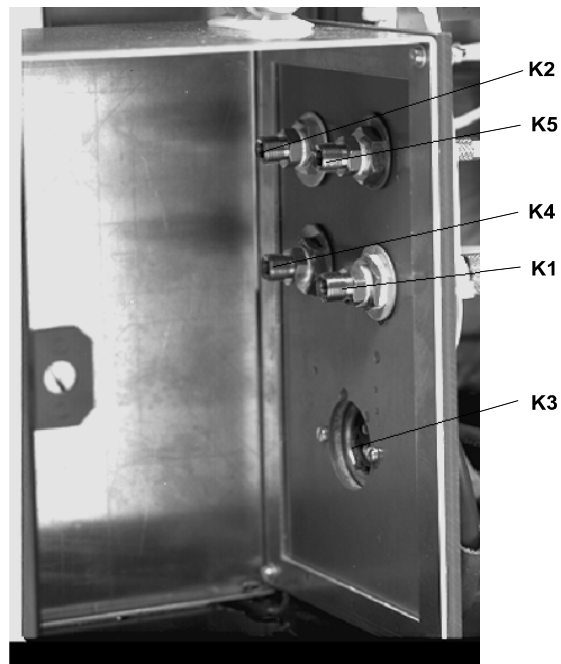
View of front panel



View of rear panel



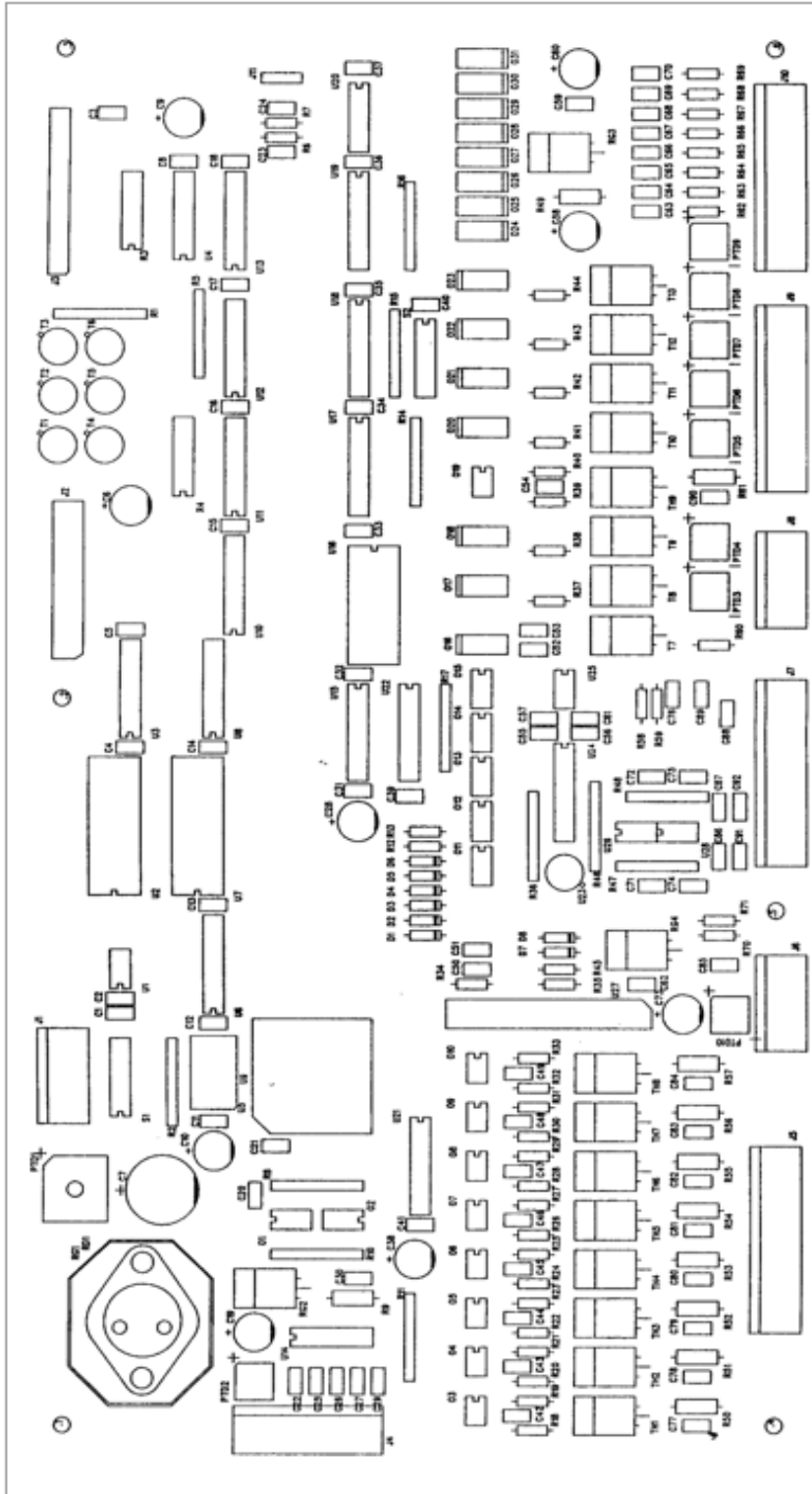
View of torch connection



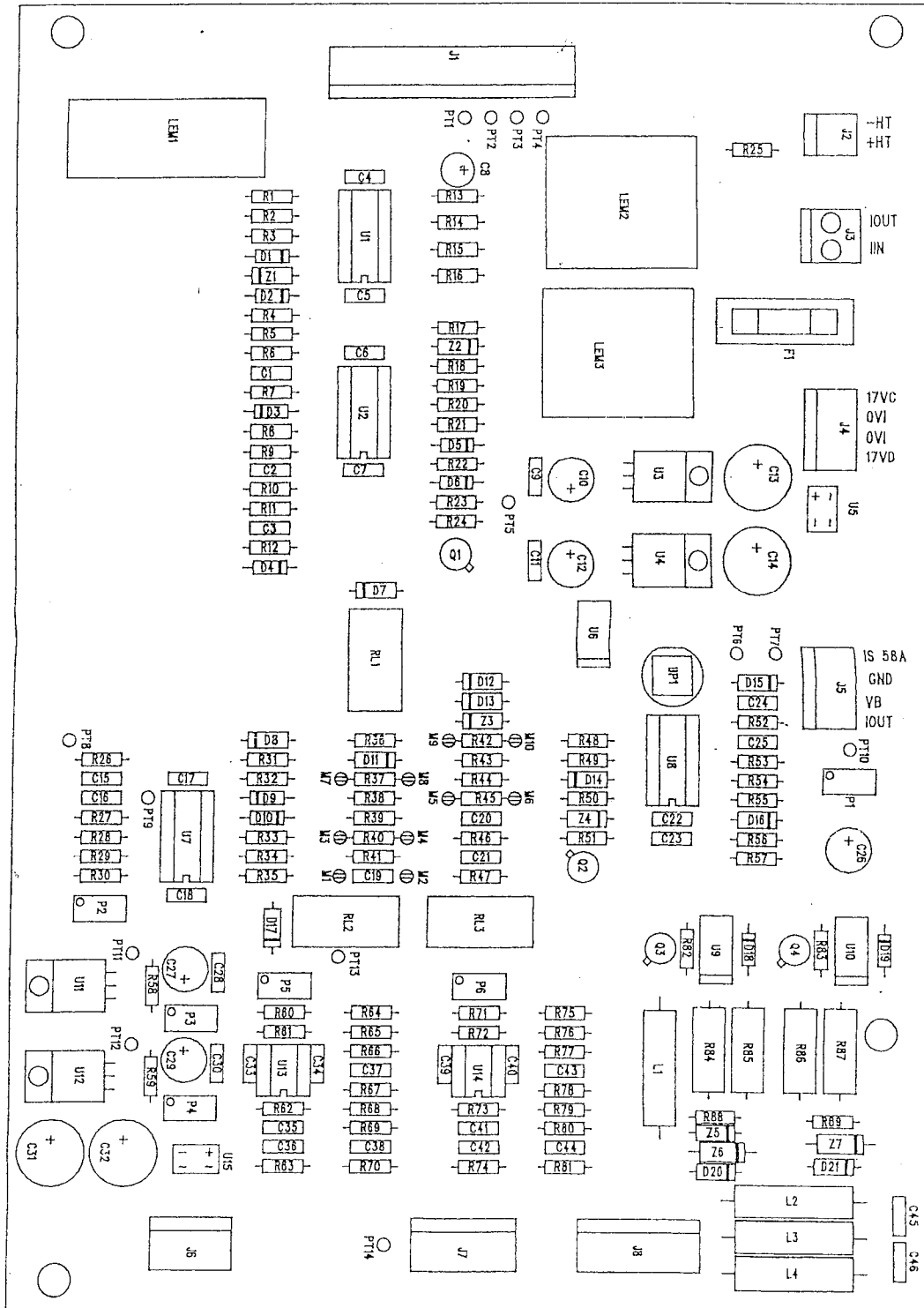
View of front panel CI (display-unit contrast adjustment



View of central processing unit card



View of control card and adjustment of linear amplifier



I - OPERATION

CONNECTION OF PLASMAFIX 51

Follow the connection procedure in Section E64 to E70

Mains - Example: Mains 400 V/50 HZ

See Page E 64

Main gas supply: 3-bar pressure regulator (Argon)

See Page E 68

Annular gas supply: 3-bar pressure regulator (Argon + Hydrogen) See Page E 68

Cooling unit connection

Electrical

Water inlet (green)

Water outlet (red)

See Pages E68 and E70

Connection of SP45 torch

Run the torch through the front panel

Trigger

K3

Central gas/pilot arc

Red

K2

Annular gas

Yellow

K5

Water/power lead-out

Green

K1

Water backflow

Blue

K4

Connection of workpiece

Earth connection N17

See Page E66

PUTTING THE PLASMAFIX 51 INTO SERVICE

Put the **GAS** in service (pressure regulator)

(Verification of possible leaks)

Fill the **REFRISAF 51** with the cooling liquid

Starting up the **PLASMAFIX 51**

Selector-switch A1 = 1 (Mains)

Signal lamp A2 ⇨ 1

LED N47 ⇨ 1

Put key N14 in programming position

LED N46 = 1

During 30 s, water safety device N51 can be activated
(pressurizing of circuit)

Wait 2 min. and validate the safety via key N15

LED N51 = 0

Check for possible water leaks

Add cooling liquid in order to reach the nominal level

STARTING UP THE PLASMAFIX 51

Once the **PLASMAFIX 51** is ready and connected,

Put selector-switch A1 in position 1

Signal lamp A2 = 1

LED N47 = 1

Display-unit N35 shows:

PLASMAFIX 51 Version 5.36	
Date	Time

In case of problem on the central processing unit card, LED N47 = 0

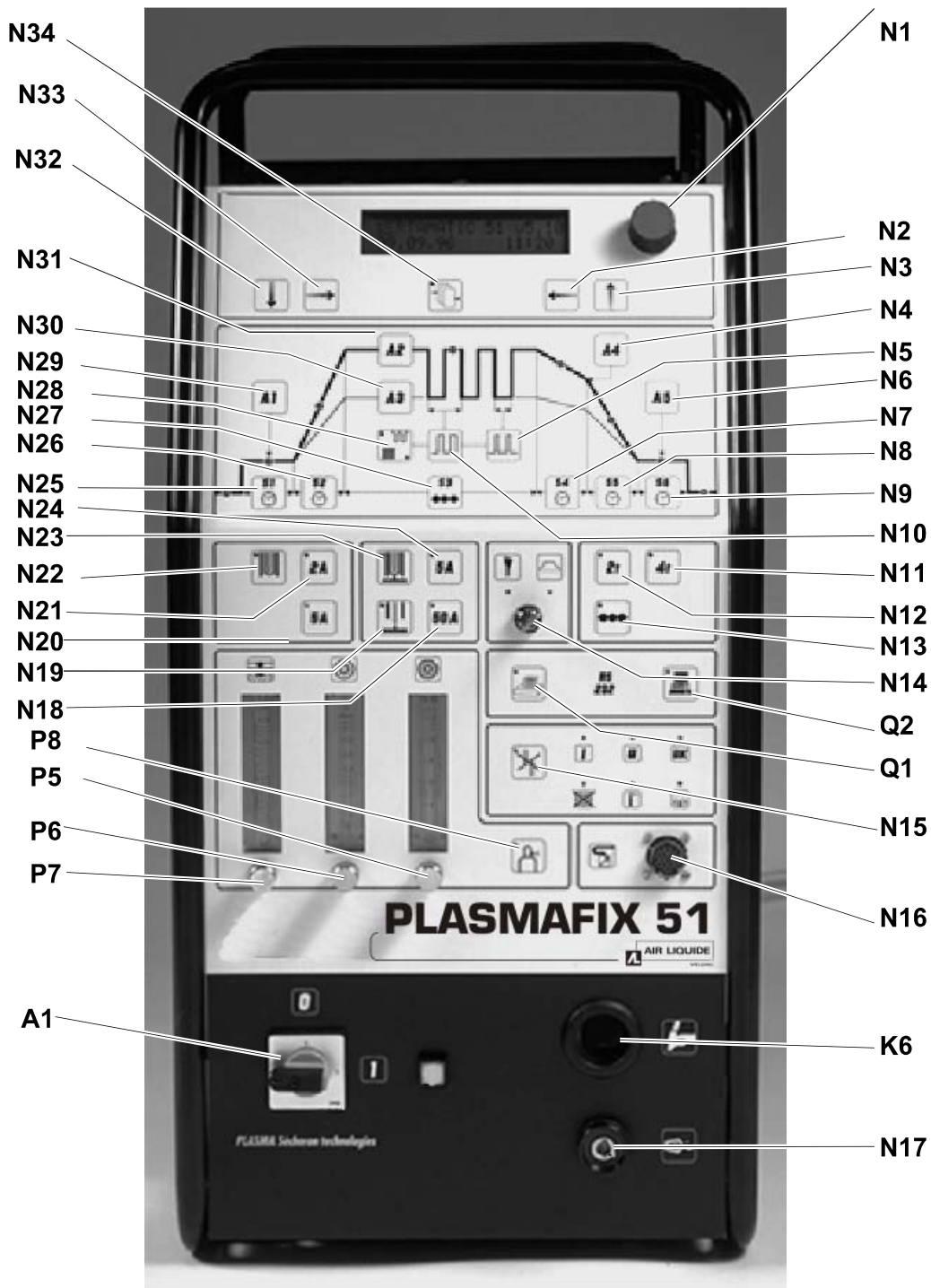
Contact the SAF after-sales department

If the Water safety device is active, LED N47 = 0, LED N51 = 1:

Validate the safety via key N15 (if it is no longer active); If the safety remains active, check the water circuit.

For the other safety features (Linear amplifier and Thermal protection), contact the SAF after-sales department.

PLASMAFIX 51 keys



PULL-DOWN MENU - DISPLAY

Display

The **PLASMAFIX 51** has an alphanumeric LCD display-unit capable of dialoguing in French, English and German (through selection in the CONFIGURATION menu).

The display-unit has 2 lines of 20 characters each.

Powering up message:	PLASMAFIX 51 Software version Date Time	
Program number or memorization message (MEMO = 000)	P = 000	Indication: Process Mode Current Frequency
Message during welding	Next line up: Next line down:	Program number Current parameter Welding voltage Welding current

See appendix I: DISPLAY-UNIT MESSAGES

Pull-down menu

Key N32 enables access to the next menu.

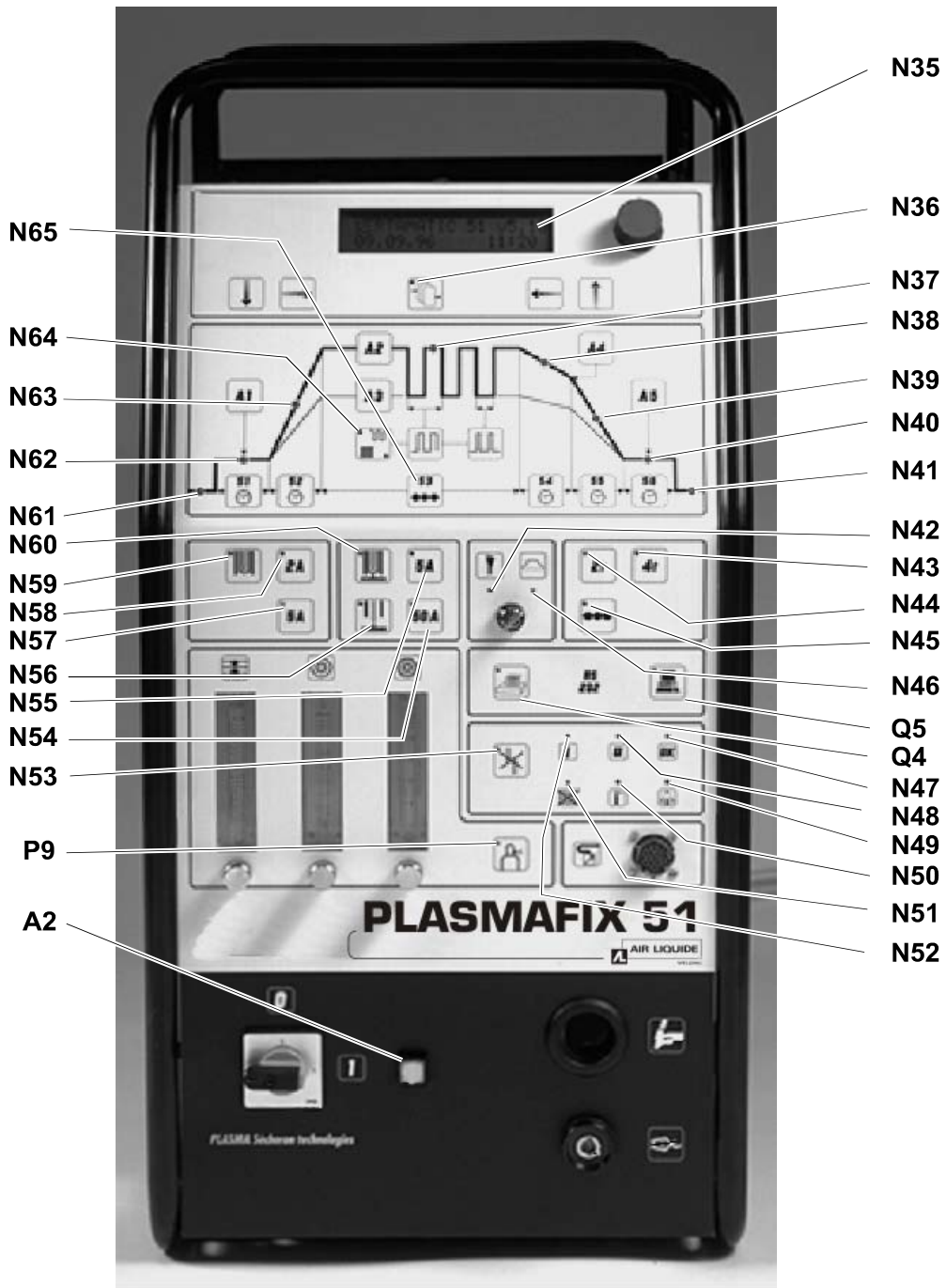
Key N3 enables access to the previous menu.

Keys N33 and N2 enable one to navigate in a menu (change of line or active parameter).

Encoder N1 enables one to vary the current parameter

Key N34 enables one to:
Call up a program, select it and make it active
Save an active program in the memory

PLASMAFIX 51 display



LED N36 = 1 during memorization

Note: The active or current program is the one which can be accessed via the front panel; it remains active until it is replaced by a program in the memory. It can be modified.

PROGRAMMING OF FRONT PANEL

Choice of PROCESS

Key N23 enables one to select the PLASMA process.
LED N60 = 1

Key N19 enables one to select the TIG process.
LED N56 = 1

Key N24 enables one to weld on the 5 A rating.
I min. = 60 mA - I max. = 5 A
LED N55 = 1

Key N18 enables one to weld on the 50 A rating.
I min. = 0.6 A - I max. = 50 A
LED N54 = 1

The precision changes, depending on the 5 or 50 A rating.
In TIG operation, access to Key N 24 is prohibited:
Unique rating: from 0.6 A to 50 A.

Choice of PILOT ARC current

Key N21 enables one to select the 2 A rating for the pilot arc:
As the external characteristics of the pilot arc source are not regulated, the pilot arc current is between 1.8 A and 3.5 A, depending on the electrode and pipe-nozzle diameters used.
See the **SP 45** Torch operating manual
LED N58 = 1
Ignition of the pilot arc is carried out automatically at the 5 A current (before switching to 2A).

Key N20 enables one to select the 5 A rating for the pilot arc:

As the external characteristics of the of pilot arc source are not regulated, the pilot arc current is between 4.5 A and 6.5 A depending on the electrode and pipe-nozzle diameters used.

See the **SP 45** Torch operating manual.

LED N57 = 1

Key N22 enables one to put the pilot arc in PLASMA process in service.

It starts up the pilot arc ignition procedure (Prewflow gas, HF).

LED N61 flashing = 1 for the main preflow gas

LED N59 = 1 when the pilot arc is ignited (pilot arc RI)

RT output = 1

The pilot arc is present for welding.

In case of pilot arc interruption, ignition is launched again

LED N48 = 1

RT output = 0

In case of Electrode/Pipe-nozzle short circuit, LED N48 = 1, RT output = 0 (without interrupting welding)

Pressing Key N22 a second time stops the pilot arc.

LED N59 = 0

LED N41 = 1 flashing during the main postflow gas time

Stopping the pilot arc takes priority over the welding (welding stop via N22)

In TIG process, these three keys are inactive.

Choice of operating mode

Key N11 enables one to select the 4-stroke mode.

LED N43 = 1

The 4-stroke mode can be used in:

TIG single-trigger

TIG double trigger

PLASMA double trigger

In this mode, Keys N25, N27, N9 are inactive.

In double trigger, the TIG and PLASMA cycles are different.

Key N12 enables one to select the 2-stroke mode.

LED N44 = 1

The 2-stroke mode can be used in:

TIG single-trigger
 PLASMA single-trigger
 TIG & PLASMA automatic

In this mode, Key N27 is inactive.

Key N27 enables one to select the spot mode.

LED N45 = 1

The spot mode can be used in:

TIG single-trigger
 PLASMA single-trigger
 TIG & PLASMA automatic

In this mode Keys N25, N27, N9 are active.

In welding phase, the trigger is inactive.

See Appendix II: OPERATING CYCLES.

Programming of welding cycle

PRE-WELDING

Key N25 enables one to set the pre-welding time parameter in 2-stroke and spot mode

This key is not active in 4-stroke mode.

Key N29 enables one to set the parameter of the pre-welding current level.

LED N62 is associated with Keys N25 and N29.

WELDING

Key N31 enables one to set the parameter for the current level during welding:

In 0 - 100 % remote-control, it modifies the maximum current.

In 0 - 50 A remote-control, it is not operative.

In Imin - Imax remote-control, pressing the key once modifies I min.; pressing the key a second time modifies I max.; pressing the key a third time pre-displays the current according to the position of the remote control.

Key N28 determines the type of current: smooth or pulsating:

Pressing the key once positions the current in low frequency pulsating.

LED N64 = 1

Pressing it a second time positions the current in high-frequency pulsating.

LED N65 = 1

Pressing the key a third time repositions the current in smooth.

Key N30 enables one to set the parameter for the low level in pulsating.

Key N10 enables one to select the frequency of the pulsating current.

Key N5 enables one to select the duty cycle of the pulsating current.
If pulsating mode is not programmed, Keys N5, N10, N30 are inactive.

Key N27 enables one to set the spot time parameter.

LED N37 is associated with Keys N31, N27, N28, N30, N10, N5.

SLOPE-OUT 1

Key N7 enables one to set the parameter for the slope-out time between the welding current and the intermediate slope-out level.

Key N4 enables one to set the parameter for the intermediate slope-out level.

LED N38 is associated with Keys N7 and N4.

SLOPE-OUT 2

Key N8 enables one to set the parameter for the slope-out time between the intermediate slope-out level and the post-welding current.

LED N39 is associated with Key N8.

POST-WELDING

Key N9 enables one to set the parameter for the post-welding time in 2-stroke and spot mode.

This key is not active in 4-stroke mode.

Key N6 enables one to set the parameter of the post-welding current level.

LED N40 is associated with Keys N9 and N6.

Each level is independent: It is possible to have pre-welding currents higher than the welding current; in the same way, the slope-out may be a build-up slope, if the post-welding current is higher than the welding current.

Programming of preflow gas and postflow gas

Preflow gas and Postflow gas time-delays are adjustable in the main menu: these time-delays are considered to have been adjusted once and for all. Should the gas time-delays be different from one application to another, the memorization stores the various values in the memory for each program. Access to the reverse gas time-delay can be programmed in the CONFIGURATION menu.

Depending on the TIG or PLASMA mode, the main gas, annular gas time-delays are replaced by the TIG gas time-delay.

TIG programming

Two parameters can be programmed, to improve ignition in TIG, in the main menu:

Ignition current and the ignition system (HF or PAC).

Access to these two parameters can be programmed in the CONFIGURATION menu.

Programming of wire and movement authorizations

Access to the wire and movement time-delays can be programmed in the configuration menu.

The wire and movement time-delays can be adjusted in the main menu. Should these time-delays be different from one application to another, the memorization stores the various values for each program in the memory.

Programming of process control

Access to I and U process control can be programmed in the configuration menu.

The high and low limits as well as the defect masking time can be adjusted in the main menu.

Should these parameters be different from one application to another, the memorization stores the various values for each program in the memory.

Locking the parameters

Key N14 enables one to lock the keyboard completely.

Each parameter can be consulted, but not modified:

During welding, the current can be modified through the remote-control depending on the remote-control mode selected: Imin - Imax or 0 - 100 %.

LED N42 indicates locking.

LED N46 indicates the possibility of programming.

Operation of RS 232 link

PRINTOUT OF ACTIVE PROGRAM

Key Q1 enables one to send the active (or current) program to a serial printer.

LED Q4 = 1 during the communication time

Operating method: Key Q2 is not activated, key Q1 enables one to print out the active program.

See Appendix IV: PARAMETER PRINTOUT

SAVING THE ACTIVE PROGRAM

Key Q2 combined with Key Q1 enables:

- A text file to be sent to the serial printer; this file corresponds to the active program according to the communication protocol described in Appendix III.
- Dialogue with the software under WINDOWS **PLASMAFIX 51**, that is, to save the active program in a microcomputer.

LED Q3 = 1 if Q2 = 1

Operating method: Key Q2 is activated; key Q1 enables one to print out the communication protocol or save the active program.

Request	Q1	Q2	Q3	Q4
Printout of active program	Yes	No	0	1
Printout of communication protocol	Yes	Yes	1	1
PLASMAFIX 51 software backup	Yes	Yes	1	1

LOADING A PROGRAM VIA THE RS 232 LINK

The opposite combination is possible:

Sending a text file which is strictly compatible with the communication protocol.

Loading programs from a microcomputer.

Operating method: The **PLASMAFIX 51** is in its main menu; the transmission of a text file or a software program number displays the MEMORIZATION menu: The program sent becomes active. It is possible to save on a number which is free or not free, depending on the operator's choice.

PROGRAM CHAINING DURING WELDING

During welding, it is possible to send a text file which is strictly compatible with the communication protocol.

The new program transmitted becomes active, and changes the welding parameters (Pulsating current).

End of welding becomes the reflection of the last program transmitted.

PRINTOUT OF PARAMETERS DURING WELDING

During welding, it is possible to print the current and voltage parameters at a printout frequency between 1 and 9.9 seconds; the parameters for this operation can be set in the CONFIGURATION menu.

At the beginning of welding, the printer receives the power source index, the date and time, and then, periodically, the U and I measurement.

GAS bleed-off

Key P8 enables one to carry out a gas bleed-off during 1 second.

Each time the key is pressed, it is memorized and added up.

To carry out a 10-second bleed-off, it is necessary to press P8 ten times.

LED P9 memorizes the total gas bleed-off time.

The external control on N16 plug is of the all-or-nothing type.

Display of safety device

When the **PLASMAFIX 51** is powered up, the central processing unit card performs a self-test. At the end of the test, LED N47 = 1 (if the central processing unit operates properly).

If N47 = 0, contact the SAF after-sales department.

Each safety device is memorized by the **PLASMAFIX 51**.

Depending on the seriousness of the problem, the welding cycle is interrupted:

SAFETY WITH WELDING STOPPAGE

Temperature of linear amplifier	N50	Red
Pressure water	N51	Red
Current > 58 A	N52	Red
Electrode/Part voltage < 8 V	N48	Red

When one of the 4 safety devices is active, N47 = 0

The **PLASMAFIX 51** switches to safety Postflow gas.

Key N15 enables one to validate the safety devices if the fault has disappeared, in order to resume a welding cycle.

Should the defect persist, contact the SAF after-sales department.

SAFETY WITHOUT WELDING STOPPAGE

Alarm	N49	Red
I process control, flashing	N52	red
U process control, flashing	N48	Red

The alarm can be stopped by pressing N15, but upon the next ignition, it is again active.

Resetting the alarm: In the CONFIGURATION menu, validate the arc control parameters via key N34.

During welding, Key N15 enables one to display the ignition number counter and the remaining alarm time (if the alarm was activated in the CONFIGURATION menu).

CONFIGURATION MENU

The configuration menu mainly enables one to display the functions which are additional to the basic functions in the main menu

Example:

Simple manual use:

Program
Memorization
Gas management

Automatic use:

- Program
- Memorization
- Gas management
- Wire and movement management
- Process control

Choice of process control

This submenu enables one to choose whether the process control functions on the current and voltage should appear in the MAIN menu.

Answer: Yes or No

Choice of movement and wire authorizations

This submenu enables one to choose whether the wire time-delay and movement time-delay functions should appear in the MAIN menu.

Answer: Yes or No

Choice of reverse gas control

This submenu enables one to choose whether the reverse gas function should appear in the main menu.

Answer: Yes or No

Choice of TIG ignition control

This submenu enables one to choose whether the TIG ignition control functions should appear in the main menu.

Answer: Yes or No

Programming of arc control (alarm)

The **PLASMAFIX 51** has an alarm enabling one to attract the operator's attention, depending on an ignition number or an operating time (for example, to change the electrode).

Adjustment of this alarm can be programmed: Yes or No

No: The alarm is inactive

Yes: A submenu appears:

Adjustment of the ignition number (from 1 to 250)

Adjustment of the operating time (from 1 H to 50 H)

It is absolutely essential to validate the value via the MEMO key (N34) after modification of the values

In operation, the ignition number or the time decreases.

When the number reaches 0, the alarm = 1 (repeated Buzzer).

To validate and reset the alarm, it is necessary to return to the CONFIGURATION menu and validate the new value via MEMO (N34).

It is possible to display the number during welding via Key N15.

Choice of user-language

This submenu enables one to choose the user-language:

French

English

German

The menus and printout are translated into the selected language.

Choice of type of remote-control

This submenu enables one to choose the type of remote-control:

Variation between two values: Imin - Imax

Variation between 0 and A2 0 - 100 %

Variation between 0 and 50 A 0 - 50 A

(between 0 and 5 A if Key N24 is operational)

This function is activated when the **PLASMAFIX 51** detects a remote-control on the N16 plug.

Choice of display of pulsating current

This submenu enables one to choose between a current display in average value or in root-mean-square.

In smooth current, the **PLASMAFIX 51** displays the welding current.

In pulsating current, the **PLASMAFIX 51** calculates the average or root-mean-square of the current, using the welding current and the programmed pulsating parameters.

The average value is the one that is usually known on welding sets. The root-mean-square is closer to the energy delivered to the part during welding.

Programming the power source index

The power source index enables one to keep a personal trace of the power source in case of program printout, printout during welding and during backup of a program.

This parameter becomes essential when one has 2 or more **PLASMAFIX 51's**

Value programmable from 1 to 99

Choice of input/output display

This choice enables one to display the input and output status during welding.

See Page J121, MAINTENANCE section

Programming of parameter printout during welding

This menu enables one to implement the parameter printout function during welding (PRINT welding).

Choice: Yes or No

No: Function inactive

Yes: A submenu appears:

Programming of printout frequency

A serial printer must be connected to the RS232 output

Printout: PLASMAFIX 51 - Revision N°
 Date/Time (of beginning of welding)
 Welding current
 Welding voltage

Setting the date

This menu enables one to set the **PLASMAFIX 51 date**.

Setting of year, month, day.

This adjustment is important in case of parameter printout during welding and printout of the active program.

Setting the time

This menu enables one to set the **PLASMAFIX 51 time**.

Setting of hour, minutes, seconds.

This adjustment is important in case of parameters printout during welding and printout of the active program.

MAIN MENU

Startup message

When **PLASMAFIX 51** is powered up (A1 selector-switch), the initial message appears:

PLASMAFIX 51		
Software version	5.36	example: Pre-series 5.20
Date	10/12/96	Adjustable in the
Time	10:55	CONFIGURATION menu

The software version depends on the EPROM
The date and time are stored in the memory

Program call-up

This menu enables one to access the choice of program which has been saved beforehand.

Notion of active program

The active program is the one which is available when the power source is started up.

It is immediately useable by the operator.

It is memorized when the power source is powered down.

Each modification of a parameter results in the modification of the active program.

The active program can be memorized under a different number in order to save it and to be able to call it up at any time (memorization of a maximum of 100 programs).

As soon as the operator calls up a program in the memory, the current active program is deleted and is supplanted by the called-up program:

The program called up becomes active.

Encoder N1 enables one to cycle through the 100 programs in the memory.

When a memory is used, the display-unit indicates:

Line 1	PRG N°	001		
	Process	PLS	TIG	
	Mode	2T	4T	PT
Line 2	Current	20.4 A	2.04 A	
	Frequency	0000 HZ	75 HZ	1500 HZ

When a memory is empty, the display-unit indicates:

Line 1	PRG N°	---		
	Process	---	---	
	Mode	--	--	--
Line 2	Current	--. A	-. A	
	Frequency	---- HZ	---- HZ	---- HZ

Operating method:

Using encoder N1, select the required program number.

Press MEMO key N34 to validate the request.

The program in memory becomes ACTIVE.

Saving a program

This menu enables one to save the active program in a memory selected by the operator.

Using encoder N1, one selects a program number.

When a memory is used, the display-unit indicates:

Line 1	PRG N°	001		
	Process	PLS	TIG	
	Mode	2T	4T	PT
Line 2	Current	20.4 A	2.04 A	
	Frequency	0000 HZ	75 HZ	1500 HZ

When a memory is empty, the display-unit indicates:

Line 1	PRG N°	---		
	Process	---	---	
	Mode	--	--	--
Line 2	Current	--. A	.-- A	
	Frequency	---- HZ	---- HZ	---- HZ

The operator selects either a free program number (blank), or a program number which is already used: In this case, it will overwrite the program in memory with the active program.

Operating method:

Using encoder N1, select the chosen program number.

Press MEMO key N34 to validate the request.

The ACTIVE program is memorized.

CAUTION: SAVING THE ACTIVE PROGRAM ON A PROGRAM NUMBER ALREADY BEING USED RESULTS IN THE ELIMINATION OF THE PROGRAM IN THE MEMORY

Programming the main gas time

This menu enables one to program the Preflow gas and Postflow gas time of the main gas circuit (PLASMA pilot arc gas).

In TIG operation, this menu disappears and is replaced by TIG gas time programming.

See Appendix III: OPERATING CYCLES.

Programming the annular gas time

This menu enables one to program the Preflow gas and Postflow gas time of the annular gas circuit (PLASMA shielding gas).

In TIG operation, this menu disappears.

See Appendix III: OPERATING CYCLES.

Programming the reverse gas time

This menu appears if it has been validated in the CONFIGURATION menu .

The reverse gas function enables one to fill a tank with shielding gas before starting welding operations up (for example).

The reverse gas option must be fitted in the **PLASMAFIX 51**.

Programming of Preflow gas and reverse Postflow gas times.

CAUTION: IF THE POWER SOURCE DOES NOT HAVE THE REVERSE GAS CIRCUIT OPTION, THE FACT OF PROGRAMMING A REVERSE PREFLOW GAS TIME RESULTS IN AN IDLE TIME BETWEEN THE TIME THE TRIGGER IS PRESSED AND THE ANNULAR PREFLOW GAS.

Programming the TIG parameters

This menu appears only in TIG, and if it has been validated in the CONFIGURATION menu.

It enables:

- Selection of the type of ignition:
 - High-frequency ignition
 - PAC system ignition

Selection of current at ignition

The current at ignition is in fact a current peak before the pre-welding current level. This peak can be adjusted in current (0 to 50 A) with duration of 0 to 0.3 seconds.

In PAC system, choose a current on the order of 5 A.

In H.F. system, choose a current on the order of 15 A.

Operating method for the PAC system

- 1) The electrode is in short circuit on the part
- 2) The operator presses the initial trigger
- 3) Ignition of current on 5 A ignition current (in short circuit)
- 4) Raising of electrode and transfer of arc to the pre-welding current
- 5) Normal cycle

If the menu has not been selected in the CONFIGURATION menu, TIG ignition is carried out in H.F. at the pre-welding current.

Programming the process control on voltage

This menu appears if it has been validated in the CONFIGURATION menu.

Process control enables monitoring of voltage during the welding sequence. It is inoperative during pre-welding and slope-out sequences.

The welding operating method imposes a reference distance between the torch (electrode) and the workpiece. A positive or negative overrun of this reference distance may be detrimental to the welding.

Process control enables one to warn of any overrun of this distance by means of a flashing LED on the front panel and through information on the N16 plug. At the electrical level, the distance variation results in an arc voltage variation: This arc voltage is monitored by the process control.

Operating method

Depending on the arc voltage during welding, one selects:

The low voltage U_m

The high voltage UM

The accepted time or the overrun defect of the U_m and UM range is not taken into account: T_{su}

In case of overrun, after time T_{su} , LED N48 flashes and the process control information = 1.

It continues to flash after the end of welding.

It is inactive by pressing on the trigger again.

Programming the process control on the current

This menu appears if it has been validated in the CONFIGURATION menu .

Process control enables monitoring of current during the welding sequence
It is inoperative during pre-welding and slope-out sequences.

The welding operating method imposes a reference current. A positive or negative overrun of this reference current may be detrimental to the welding. Process control enables one to warn of any overrun by means of a flashing LED on the front panel and by information on the N16 plug.

Operating method

Depending on the A2 welding current parameter and taking account of possible variations at the remote-control level, one selects:

The low current I_m

The high current IM

The accepted time or the overrun defect of the I_m and IM range is not taken into account: T_{si}

In case of overrun; after time T_{si} , LED N52 flashes and the process control information = 1.

It continues to flash after the end of welding.

It is inactive by pressing the trigger again.

Programming the Wire authorization time

This menu appears if it has been validated in the CONFIGURATION menu.

This menu enables one to program the time-delays at filler wire startup and stopping.

Depending on these time-delays, an information item is given for a control external to the **PLASMAFIX 51** on the N16 plug.

See Appendix III: OPERATING CYCLES.

Programming the Movement authorization time

This menu appears if it has been validated in the CONFIGURATION menu.

This menu enables one to program the time-delays at the startup and stopping of an external movement.

Depending on these time-delays, an information item is given for a control external to the **PLASMAFIX 51** on the N16 plug.

See Appendix III: OPERATING CYCLES.

DIAGNOSIS MENU

This menu is accessible from main menu.

Choice: Yes/No

Once selected, this menu triggers a **PLASMAFIX 51** SELF-TEST.

See Page J119 of the MAINTENANCE section.

WELDING CYCLE

The PLASMA welding cycle can be controlled with one or two triggers (2 triggers in 4-stroke).

It is compatible with former PLASMA cycles (SECHERON, PLASMAFIX, NERTAMATIC 50).

The TIG welding cycle is different from the PLASMA cycle; the TIG cycle complies with the cycle developed by SAF (PRESTOTIG 250...).

It operates both in 2 or 4-stroke, with 1 or 2 triggers.

Display of welding cycle

The N37 to N41, N61 to N63 display LED's remain on (continuous) at each cycle sequence; this enables the operator to display the current cycle.

Reminder: The LED's flash in case of parameter variation

In case of arc interruption in a sequence, the sequence LED remains on (continuous) until the operator again presses the initial trigger.

The **PLASMAFIX 51** switches to safety Postflow gas.

Process control is active only for the welding phase (A2)

In case of process control fault, LED N51 or LED N52 lights up and flashes, and remains in this state until the next time the initial trigger is pressed.

See Appendix II: OPERATING CYCLES.

AUTOMATIC OPERATION

The automatic cycle is comparable to the 2-stroke, 1 trigger cycle.

Cycle control: Initial trigger

Output: Pilot arc source voltage relay
Main source current relay
(welding)
Wire authorization information
Movement authorization information
Process control information

The IN/OUT display device enables one to display the inputs and outputs during operation and welding cycle.

See Page J121, MAINTENANCE section.

J - MAINTENANCE

PLASMAFIX 51 maintenance is structured around:

- A diagnosis menu enabling testing of the front panel as well as the various electrical sources and miscellaneous auxiliaries
- Display of inputs and outputs during welding
- A sequence number simulation during operation in order to identify the cycle phase where the fault occurs

DIAGNOSIS Menu

The Diagnosis Menu is accessible from the main menu

Choice via N32 and N33 keys

N1 encoder for validation of menu

At each test, the N35 display-unit provides specific information

Certain tests are validated via the MEMO N34 key

Switching from one test to the next is carried out through action on the N3 or N32 keys

See Appendix 1 (Pages 1.k to 1.p) for the display-unit messages

Initial test	Keys N3, N32 and N35 display-unit
Test 1	<i>Keyboard arrow keys and MEMO:</i> N2, N33, N34 Led N36 = 1
Test 2	<i>Keyboard keys time:</i> N25, N26, N27, N7, N8, N9 Led N62, N63, N37, N38, N39, N40 = 1 (Continuous)
Test 3	<i>Keyboard keys amperes:</i> N29, N30, N31, N4, N6 Led N62, N63, N37, N38, N39, N40 = 1 (Flashing)
Test 4	<i>Keyboard keys Frequency:</i> N28, N5, N10 Led N64, N65 = 1 (Continuous for N28, flashing for N5 and N10)
Test 5	<i>Keyboard keys pilot arc:</i> N20, N21, N22 Led N57, N58, N59 = 1
Test 6	<i>Keyboard keys process:</i> N18, N19, N23, N24 Led N54, N55, N56, N60 = 1
Test 7	<i>Keyboard keys mode:</i> N 11, N12, N13 Led N43, N44, N45 = 1

- Test 8 *Keyboard keys cancel error: N53*
Led N15, N47, N48, N49, N50, N51, N52 = 1 (Continuous)
- Test 9 *Keyboard + Remote control, gas bleed-off: key P8*
Led N61, N41, P9 = 1
- Test 10 *N16 remote control test: Presence 0/1*
Potentiometer: Variation from 0 to 25.5 on N35 display-unit
- Test 11 *Adjustment test (encoder): Key N14 = 0/1*
Led N42, N46 = 1
Encoder, min. to max.: Variation from 0 to 25 on N35 display-unit
- Test 12 *Serial link test: Keys Q1, Q2*
Led Q3, Q4 = 1
Printout on connected serial printer: PLASMAFIX 51
or PLASMAFIX P+T depending on position of selector-switch S1 (1)
- Test 13 *Trigger test: On torch connector or on remote control: Initial trigger, final trigger*
Led N61 and N41 = 1
- Test 14 *Ignition source test*
106 V voltage between electrode and pipe-nozzle by pressing MEMO
- Test 15 *2 A auxiliary source test*
46 V voltage between electrode and pipe-nozzle by pressing MEMO
4.5 A current between electrode and pipe-nozzle (in short circuit) by pressing MEMO
Voltage relay external output = 1
The voltage relay output must be connected to an external equipment item (relay or signal lamp), output via static relay
- Test 16 *5 A auxiliary source test*
46 V voltage between electrode and pipe-nozzle by pressing MEMO
9 A current between electrode and pipe-nozzle (in short circuit) by pressing MEMO
- Test 17 *Main source test (linear amplifier) on the small range*
50 V voltage between electrode and part by pressing MEMO
1 A current between electrode and part (in short circuit)
Put the electrode and part in short circuit and press MEMO
Display of current on N35
Current relay external output = 1
The current relay output must be connected to an external equipment item (relay or signal lamp), output via static relay

- Test 18 *Main source test (linear amplifier)* on the large range
50 V voltage between electrode and part by pressing MEMO
10 A current between electrode and part (in short circuit)
Put the electrode and part in short circuit and press MEMO
Display of current on N35
Current relay external output = 1
The current relay output must be connected to an external equipment item (relay or signal lamp), output via static relay
- Test 19 *Main gas solenoid valve test* by pressing MEMO
Flowrate adjustment via P6
- Test 20 *Annular gas solenoid valve test* by pressing MEMO
Flowrate adjustment via P5
- Test 21 *Reverse gas solenoid valve test* by pressing MEMO
Flowrate adjustment via P7 (OPTION)
- Test 22 *High frequency test* by pressing MEMO
(disconnect numerical device)
- Test 23 *Movement control output test*
The movement output must be connected to an external equipment item (relay or signal lamp) - output via static relay = 1 via MEMO key
- Test 24 *Wire control output test*
The wire output must be connected to an external equipment item (relay or signal lamp), output via static relay = 1 via MEMO key
- Test 25 *Voltage process control test*
The process control output must be connected to an external equipment item (relay or signal lamp) - output via static relay = 1 when the voltage adjustable via N1 encoder is between 15 and 25 V
Led N48 = 1 (flashing)
- Test 26 *Current process control test*
The process control output must be connected to an external equipment item (relay or signal lamp) - output via static relay = 1 when the current adjustable via N1 encoder is between 10 and 20 A
Led N52 = 1 (flashing)

IN/OUT indication

When this option is selected in the configuration menu, the top line of the display-unit shows a message in binary notation when the *PLASMAFIX 51* is positioned in use phase (pilot arc or welding).

This line is comprised of 8 figures, 0 or 1, corresponding to the inputs, followed by 6 figures, 0 or 1, corresponding to the outputs.

1	2	3	4	5	6	7	8		9	10	11	12	13	14
IN	IN	IN	IN	IN	IN	IN	IN		OUT	OUT	OUT	OUT	OUT	OUT
0	0	0	1	1	0	0	0		0	0	0	0	0	0

N°	IN INPUTS
1	Voltage relay (S.A.)
2	Remote Control presence
3	Standby
4	Water safety device
5	Temperature safety device
6	Immediately stop
7	Final trigger
8	Initial trigger

N°	OUT OUTPUTS
9	Process Control active
10	Reverse gas control
11	Wire authorization
12	Movement authorization
13	Voltage relay (A.P.)
14	Current relay

Position of selector-switches on the central processing unit card

The *PLASMAFIX 51* central processing unit card has two series of selector-switches, each with 8 positions.

These selector-switches, referenced S1 and S2, are placed:

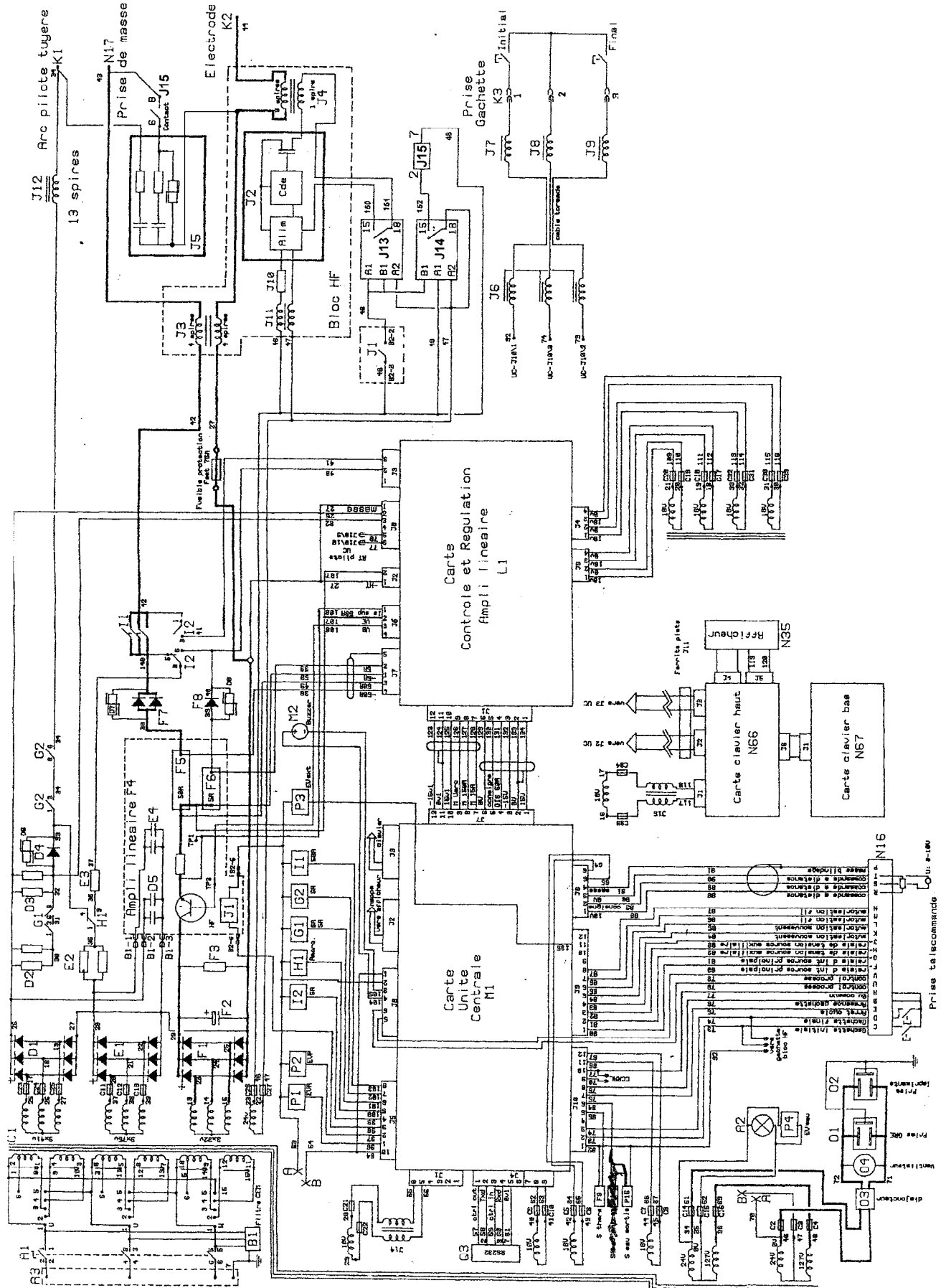
Switch 1 (Microcontroller proximity)

1	ON	Name =PLASMAFIX 51
2	OFF	
3	OFF ON	Normal Erase the RAM memory
4	OFF ON	Short- circuit detection in TIG mode No detection
5		Not used
6		Not used
7		Not used
8	OFF ON	Normal Reset UC

Switch 2 (optical range proximity)

1 à 8	Reserved for check and adjustment on factory
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ELECTRICAL DRAWING



J-106



PLASMAFIX 51

K - SERVICING

Keeping the **PLASMAFIX 51** in good working order requires a minimum of servicing. The information below specifies the operations to be carried out by the user.

The frequency of these operations obviously depends on use conditions (dusty workshops...). On the average, these operations must be carried out every 6 months.

FRONT PANEL

As the front panel is made of LEXAN, it is absolutely essential to clean it with a non-granular cloth soaked in a washing product. Solvent-base and alcohol-base products are prohibited.

TRANSFORMER - INTERNAL BODY

From time to time, it is necessary to blow out the inside of the power source with a dry compressed air jet, not exceeding a pressure of 2 Bars.

POWER CIRCUIT

Make sure that all the terminals are properly tightened in order to ensure good electrical contact.

Make sure that the linear amplifier radiator is not dirty.

ELECTRONIC CARDS

From time to time, it is necessary to blow out the component part, preferably with a neutral gas (Argon or Nitrogen).

Check that the card and integrated circuit connectors are properly fastened to the support.

WATER CIRCUIT

Routinely drain the **PLASMAFIX 51** water circuit; check the condition of the hoses and the connections to the linear amplifier.

This operation must be carried out with the power source energized.

GAS CIRCUIT

Bleeding the circuit off may be carried out with a neutral gas (NITROGEN).

