SanRex

400MP

INVERTER ARC WELDER

Operators Manual

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1.0 INTRODUCTION AND DESCRIPTION

1.01 Description

The SanRex 400MP is a single & three-phase DC arc welding power source with Constant Current (CC) and Constant Voltage (CV) output characteristics. This unit is equipped with a Digital Volt/Amperage meter, lift arc starter for use with Gas Tungsten Arc Welding (GTAW), Arc Control and Hot Start for Shielded Metal Arc Welding (SMAW), Inductance Control for Gas Metal Arc Welding (GMAW) processes and built-in Pulsed Gas Metal Arc Welding (GMAW-P) that include 16 pre-programmed factory pulse schedules.

The power source is totally enclosed in an impact resistant, flame resistant and non-conductive plastic case

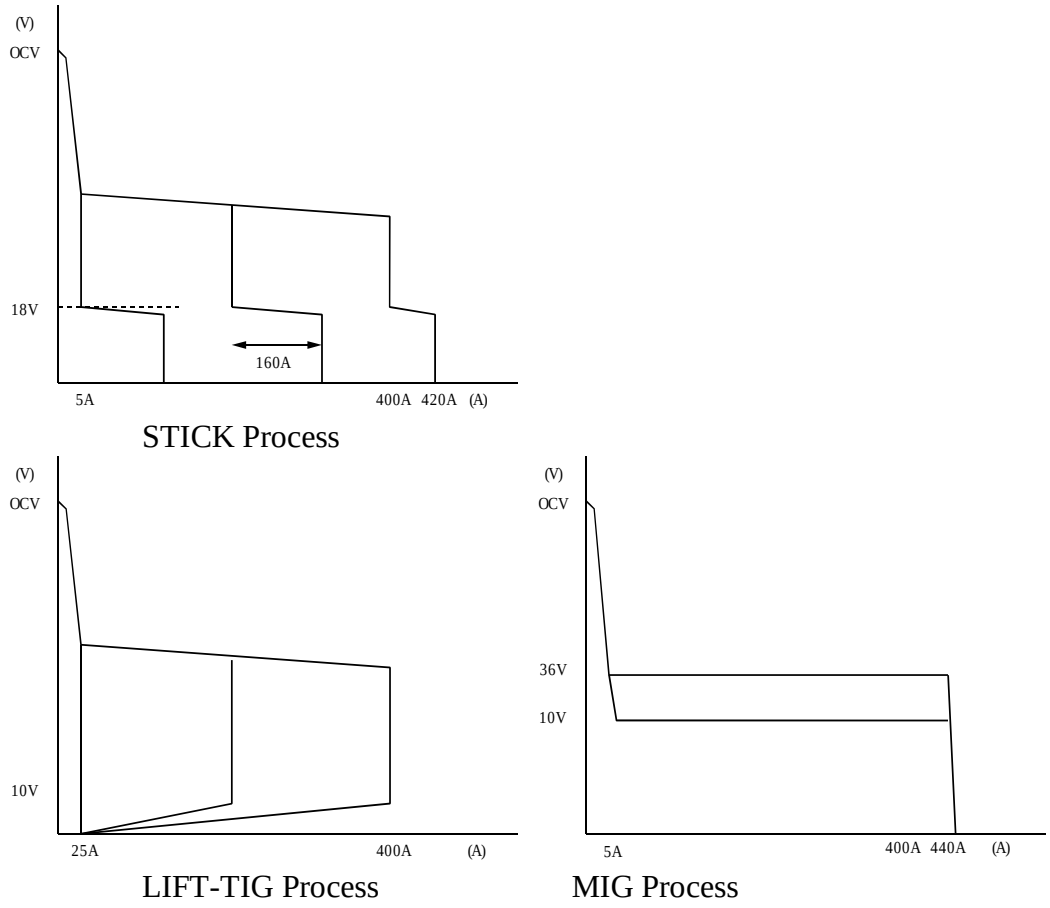


Figure 1-1 SanRex Model 400MP volt-ampere curve

Note 1

Volt-Ampere curves show the maximum Voltage and Amperage output capabilities of the welding power source. Curves of other settings will fall between the curves shown above.

1.02 Functional Block Diagrams

Figure 1-2 illustrates the functional block diagram of the 400MP-power supply.

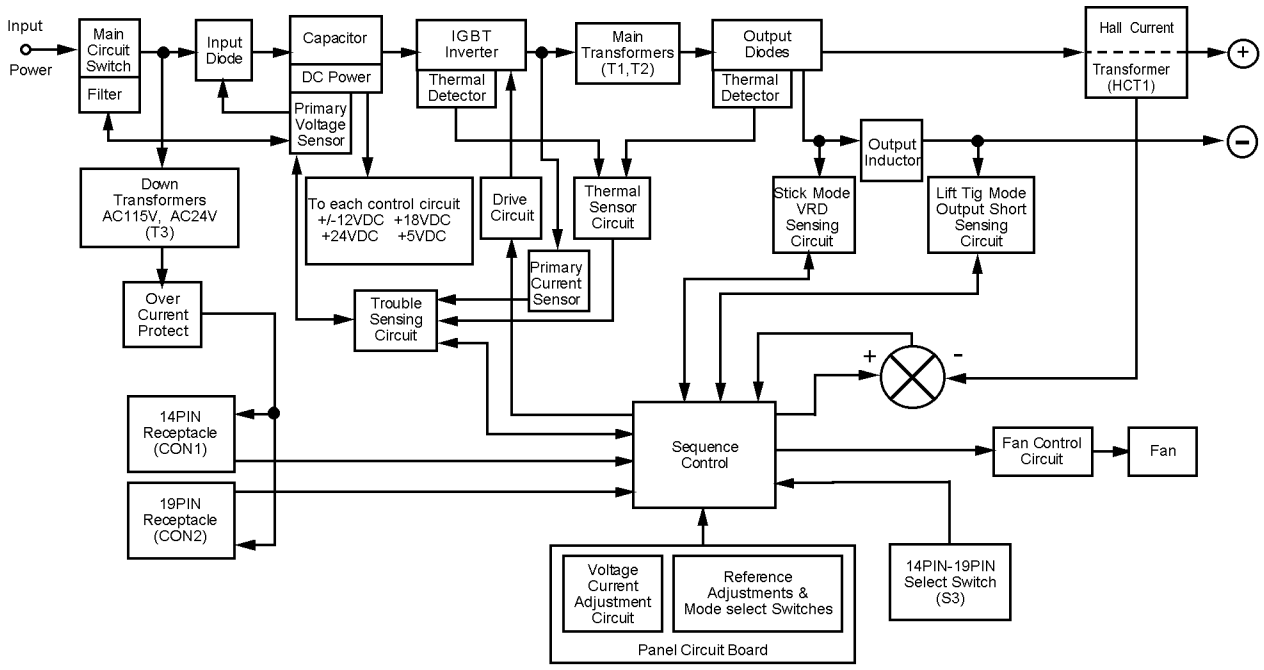


Figure 1-2 SanRex Model 400MP functional block diagram

1.03 Transporting Methods

These units are equipped with a handle for carrying purposes.

WARNING 1

ELECTRIC SHOCK can kill. DO NOT TOUCH live electrical parts. Disconnect input power conductors from de-energized supply line before moving the welding power source.

WARNING 2

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

Lift unit with handle on top of case.
Use handcart or similar device of adequate capacity.
If using a fork lift vehicle, place and secure unit on a proper skid before transporting.

2.0 INSTALLATION RECOMMENDATIONS

2.01 Environment

The SanRex 400MP is designed for use in hazardous environments.

Examples of environments with increased hazardous conditions are -

a. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts;

b. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator, or

c. In wet or damp hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulation properties of accessories.

Environments with adverse conditions do not include places where electrically conductive parts in the near vicinity of the operator, which can cause increased hazard, have been insulated.

2.02 Location

Be sure to locate the welder according to the following guidelines:

- *In areas, free from moisture and dust.*
- *Ambient temperature between 0 degrees C to 40 degrees C.*
- *In areas, free from oil, steam and corrosive gases.*
- *In areas, not subjected to abnormal vibration or shock.*
- *In areas, not exposed to direct sunlight or rain.*
- *Place at a distance of 12" (304.79mm) or more from walls or similar that could restrict natural airflow for cooling.*

WARNING 3

SanRex advises that this equipment be electrically connected by a qualified electrician.

2.03 Electrical Input Connections

WARNING 4

ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power.

DO NOT TOUCH live electrical parts.
SHUT DOWN the welding power source, disconnect input power employing lockout/tagout procedures. Lockout/tagout procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device. Refer to OSHA or NFPA for rules regarding lockout/tagout procedures.

2.03.01 Electrical Input Requirements

Operate the welding power source from a single or three-phase 50/60 Hz, AC power supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and inspection required.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power supply whenever necessary to inspect or service the unit.

Note 2

These units are equipped with a three-conductor with earth power cable that is connected at the welding power source end for single or three-phase electrical input power.

Do not connect an input (WHITE, BLACK or RED) conductor to the ground terminal.

Do not connect the ground (GREEN) conductor to an input line terminal.

Refer to figure 3 and:

1. Connect end of ground (GREEN) conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. Connect ends of line 1 (BLACK) and line 2 (WHITE) and line 3 (RED) input conductors to a de-energized line disconnect switch.
3. Use Table 2-1 and Table 2-2 as a guide to select line fuses for the disconnect switch.

Note 3

For Single-Phase operation connect the GREEN, BLACK and WHITE input conductors. Insolate the RED conductor, it is not used for Single-Phase operation.

Input Voltage	Maximum Fuse Size
208 VAC	100 Amps
230 VAC	90 Amps
460 VAC	30 Amps

Table 2-1 Electrical Input Connections

Note 4

Maximum Fuse Size is based on not more than 200 percent of the rated input amperage of the welding power source (National Electrical Code Article 630).

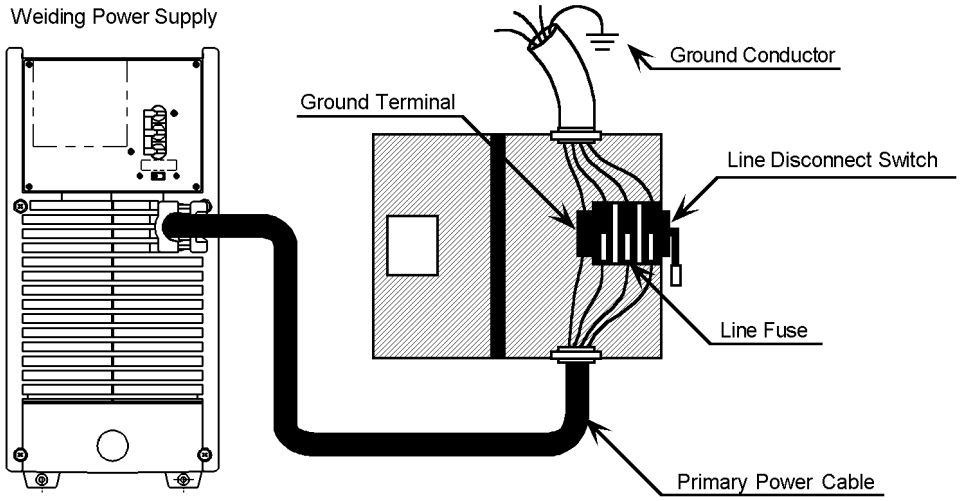


Figure 2-1 Electrical input connections

2.03.02 Input Power

Each unit incorporates an INRUSH circuit and input voltage sensing circuit. When the MAIN SWITCH is turned on, the inrush circuit provides a pre-charging of the input capacitors. SCR's in the Power Control Assembly (PCA) will turn on after the input capacitors have charged to full operating voltage (after approximately 5 seconds).

Note 5

Note the available input power. Damage to the PCA could occur if 575VAC or higher is applied.

The following 208-230/460V Primary Current recommendations are required to obtain the maximum welding current and duty cycle from this welding equipment:

<table>
<tr><th rowspan="2">Model</th><th rowspan="2">Primary Supply Lead Size</th><th colspan="2" rowspan="2">Minimum Primary Current Circuit Size (Vin/Amps)</th><th colspan="3">Current & Duty Cycle</th></tr>
<tr><th>MIG</th><th>TIG</th><th>STICK</th></tr>
<tr><td rowspan="14">SanRex 400MP</td><td rowspan="9">8/4 AWG minimum (Factory Fitted)</td><td rowspan="9">3 ϕ</td><td>208/63</td><td rowspan="3">400A @ 25%</td><td>-</td><td>-</td></tr>
<tr><td>230/57</td><td>-</td><td>-</td></tr>
<tr><td>460/29</td><td>-</td><td>-</td></tr>
<tr><td>208/49</td><td>-</td><td rowspan="3">400A @ 25%</td><td>-</td></tr>
<tr><td>230/44</td><td>-</td><td>-</td></tr>
<tr><td>460/22</td><td>-</td><td>-</td></tr>
<tr><td>208/67</td><td>-</td><td>-</td><td rowspan="3">400A @ 25%</td></tr>
<tr><td>230/61</td><td>-</td><td>-</td></tr>
<tr><td>460/31</td><td>-</td><td>-</td></tr>
<tr><td rowspan="5">8/3 AWG minimum</td><td rowspan="5">1 ϕ</td><td>208/88</td><td rowspan="2">300A @ 25%</td><td>-</td><td>-</td></tr>
<tr><td>230/79</td><td>-</td><td>-</td></tr>
<tr><td>208/67</td><td>-</td><td rowspan="2">300A @ 25%</td><td>-</td></tr>
<tr><td>230/60</td><td>-</td><td>-</td></tr>
<tr><td>208/97</td><td>-</td><td>-</td><td rowspan="2">300A @ 25%</td></tr>
<tr><td>230/87</td><td>-</td><td>-</td></tr>
</table>

Table 2-2 – Primary Current Circuit sizes to achieve maximum current

The SanRex 400MP is designed for use with a generator as an input power source. Contact a professional electrician for the proper sizing and set-up recommendations of a generator power source system. As a general rule, depending on the type of generator used, the generator capacity should be twice the maximum rating of the welder.

2.03.03 High Frequency Introduction

The importance of correct installation of high frequency welding equipment cannot be over-emphasized. Interference due to high frequency initiated or stabilized arc is almost invariably traced to improper installation. The following information is intended as a guide for personnel installing high frequency welding machines.

Warning

Explosives

The high frequency section of this machine has an output similar to a radio transmitter. The machine should NOT be used in the vicinity of blasting operations due to the danger of premature firing.

Computers

It is also possible that operation close to computer installations may cause computer malfunction.

2.03.04 High Frequency Interference

Interference may be transmitted by a high frequency initiated or stabilized arc-welding machine in the following ways:

Direct Radiation

Radiation from the machine can occur if the case is metal and is not properly grounded. It can occur through apertures such as open access panels. The shielding of the high frequency unit in the Power Source will prevent direct radiation if the equipment is properly grounded.

Transmission via the Supply Lead

Without adequate shielding and filtering, high frequency energy may be fed to the wiring within the installation (mains) by direct coupling. The energy is then transmitted by both radiation and conduction. Adequate shielding and filtering is provided in the Power Source.

Radiation from Welding Leads

Radiated interference from welding leads, although pronounced in the vicinity of the leads, diminishes rapidly with distance. Keeping leads as short as possible will minimize this type of interference. Looping and suspending of leads should be avoided where possible.

Re-radiation from Unearthed Metallic Objects

A major factor contributing to interference is re-radiation from unearthed metallic objects close to the welding leads. Effective grounding of such objects will prevent re-radiation in most cases.

2.04 Specifications

MODEL		**400MP**	
Description		DC STICK/LIFT TIG/MIG	
Rated Output Amperes Volts Duty Cycle		 400 36 25%	
Duty Cycle	TIG	400A / 26V @ 25%	
		300A / 22V @ 60%	
		200A / 18V @ 100%	
	STICK	400A / 36V @ 25%	
		300A / 32V @ 60%	
		200A / 28V @ 100%	
	MIG	400A / 34V @ 25%	
		300A / 29V @ 60%	
		200A / 24V @ 100%	
Output Current Range	TIG STICK	5 – 400A (@ 3ϕ input power)	
Output Voltage Range	MIG	10 – 36V	
Open Circuit Voltage		65V	
Dimensions Width Height Length Weight		 8.27” (210mm) 16.89” (420mm) 17.72” (450mm) 55.1 lb. 25 kg	
Output @ Rated Load		Three-Phase	Single-Phase
Rated Input Voltage		208-230/460V	208-230V
Output Amperes		400A	300A
Output Volts		36V	32V
Duty Cycle		25%	25%
KVA		24	20
KW		18	12
Output @ No Load KVA KW		 0.5 0.13	 0.5 0.13
Input Volts Single Phase		Amperage Draw @ Rated Load	No Load
208V		97	2.4
230V		87	1.8
Input Volts Three Phase			
208V		67	1.4
230V		61	1.3
460V		31	0.7

SanRex continuously strives to produce the best product possible and therefore reserves the right to change, improve or revise the specifications or design of this or any product without prior notice. Such updates or changes do not entitle the buyer of equipment previously sold or shipped to the corresponding changes, updates, improvements or replacement of such items.
The values specified in the table above are optimal values, your values may differ. Individual equipment may differ from the above specifications due to in part, but not exclusively, to any one or more of the following; variations or changes in manufactured components, installation location and conditions and local power grid supply conditions.

2.05 Duty Cycle

The duty cycle of a welding power source is the percentage of a ten (10) minute period that it can be operated at a given output without causing overheating and damage to the unit. If the welding amperes decrease, the duty cycle increases. If the welding amperes are increased beyond the rated output, the duty cycle will decrease.

WARNING 5

Exceeding the duty cycle ratings will cause the thermal overload protection circuit to become energized and shut down the output until the unit has cooled to normal operating temperature.

CAUTION 1

Continually exceeding the duty cycle ratings can cause damage to the welding power source and will void the manufactures warranty.

NOTE 6

Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

3.0 OPERATOR CONTROLS

3.01 SanRex 400MP Controls

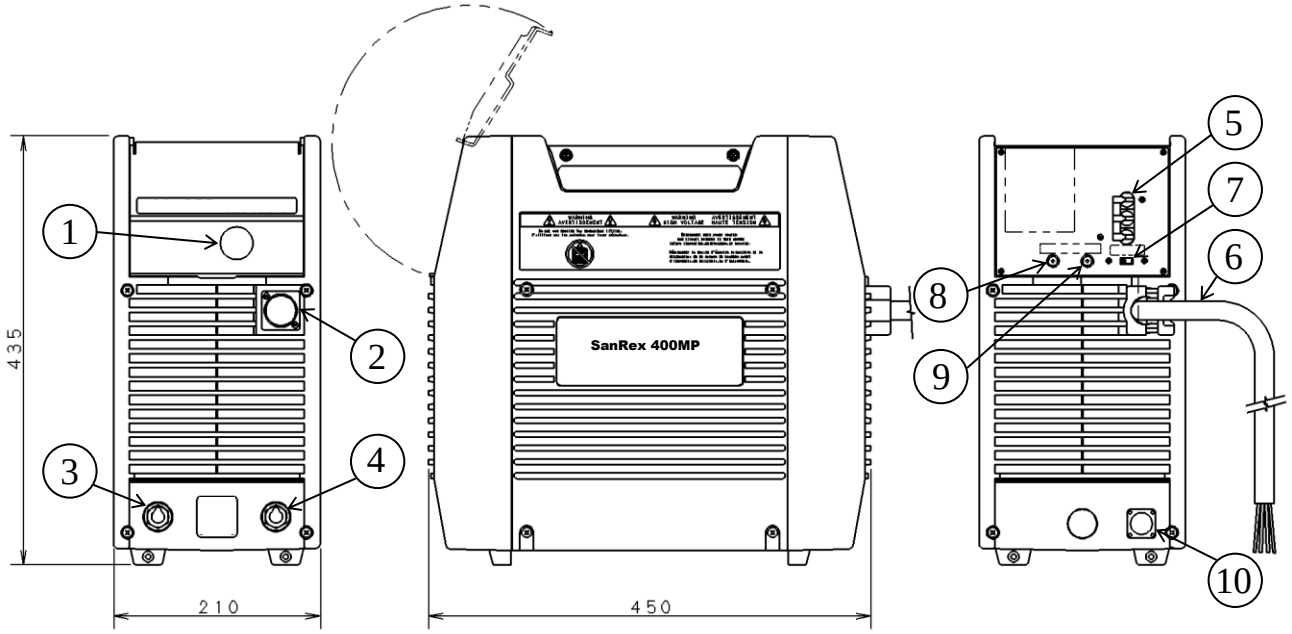


Figure 3-1 SanRex 400MP Power Source

1. Control Knob: This control sets the selected weld parameter, rotating it clockwise increases the parameter that is indicated on the digital meter. Pushing the knob inward displays the actual welding voltage.

2. Remote Control Socket: The 14-pin Remote Control Socket is used to connect remote current control devices to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

3. Positive Terminal: Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

Socket Pin	Function
A	24VAC auxiliary high side.
B	Input to energize solid state contactor. (Contact closure between pin A and pin B)
C	5k ohm (maximum) connection to 5k ohm remote control potentiometer
D	Zero ohm (minimum) connection to 5k ohm remote control potentiometer
E	Wiper arm connection to 5k ohm remote control potentiometer
F	Current feedback Ifb = 100Amps/Volt
G	24/115 VAC circuit common, also connected to chassis
H	Voltage Feedback Vfb = 10 Arc Volts/Volt
I	115 VAC auxiliary high side
J	115 VAC input to energize solid state contactor (Contact closure between pin I and pin J)
K	Chassis ground
L	Not used
M	Current Detect
N	Current Detect

Table 3-1: Socket 14-Pin Functions

4. **Negative Terminal:** Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal and/or melting of the housing (case).

5. **ON/OFF Switch:** This switch connects the Primary supply voltage to the inverter when in the ON position. This enables the Power Supply.

WARNING

When the welder is connected to the Primary supply voltage, the internal electrical components may be at 500V potential with respect to earth.

6. **Input Cable:** The input cable connects the Primary supply voltage to the equipment.

7. **Voltage Input Select Switch (Smart Logic Switch):** User selectable switch. A manual slide switch selects the proper input voltage range. If this slide switch is not set to the position that matches the input line voltage, the Smart Logic will inhibit the welding power source from turning on and a warning indication will be displayed

WARNING

Do not alter the position of the Voltage Input Select Switch when the ON/OFF Switch is in the ON position and the unit is powered up.

8. **24VAC Remote Device C/B:** Push to reset. Controls the 24VAC power source for the wire feeders controlled through the Remote Control Sockets.

9. **115VAC Remote Device C/B:** Push to reset. Controls the 115VAC power source for the wire feeders controlled through the Remote Control Sockets.

10. **Remote Control Socket:** The 10-pin Remote Control Socket is used to connect a remote control device for Pulse-MIG welding. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

Socket Pin	Function
1	5 VDC auxiliary high side
2	Communication signal
3	Communication signal
4	Communication signal
5	Communication signal
6	5 VDC neutral
7	Chassis ground
8	N/C
9	N/C
10	N/C

Table 3-2: Socket 10-pin Functions

3.02 Weld Parameter Descriptions for SanRex 400MP

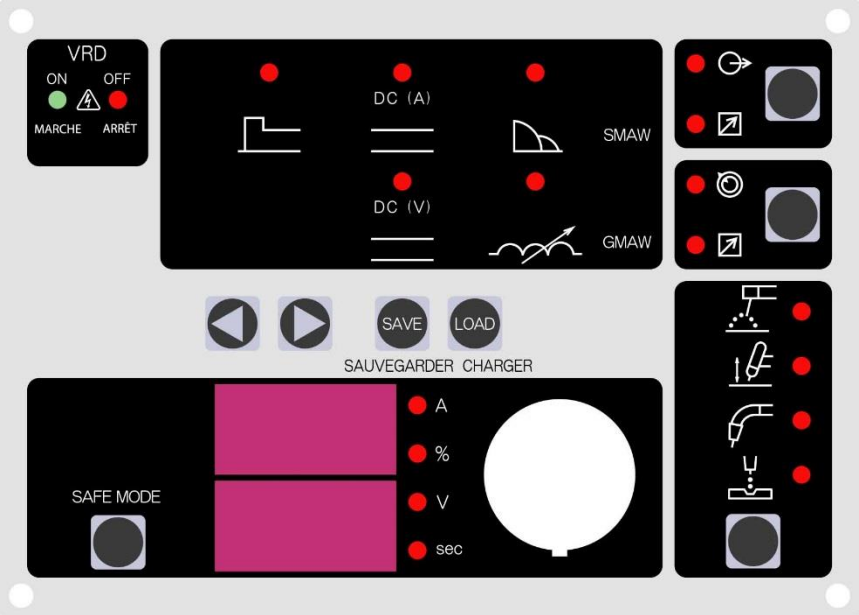
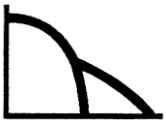
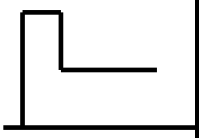
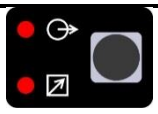


Figure 3-2. SanRex 400MP Front Panel with Parameter Description

Parameter	Description
 *ARC CONTROL*	This parameter provides a suitable short circuit current in STICK welding to improve electrode sticking and arc stability.
 *HOT START*	This parameter operates in STICK weld mode and is used to improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. It sets the peak start current on top of the *(WELD)* current.
DC (A) 	Weld Current (Amperage)- when lit parameter knob sets the STICK and TIG WELD current.
DC (V) 	Weld Voltage (Volt) – when lit parameter knob sets the MIG voltage.
 *Contactor ON/OFF*	Contactor operation in Stick Mode.

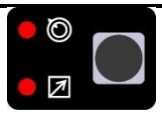
Parameter	Description
 *Operation PANEL/REMOTE*	Selects in operation Panel board or Remote.
 *INDUCTANCE*	This parameter, similar to the ARC CONTROL in STICK mode, allows for the adjustment of the dynamic property of the arc. As the inductance is increased the output voltage may need to be adjusted to achieve the desired weld characteristics.
	The SAVE/LOAD buttons are used to save and retrieve a total number of 5 programs into the 400MP memory.

Table 3-3: Weld Parameter Descriptions for SanRex 400MP

3.03 Weld Process selection for the 400MP

	Weld Mode				
Weld Parameter	**STICK**	**MIG**	**PULSED MIG**	**LIFT TIG**	**Description**
WELD (V)	✗	✓	✗	✗	Weld voltage MIG Mode.
INDUCTANCE	✗	✓	✗	✗	Inductance control in MIG Mode.
HOT START	✓	✗	✗	✗	Start current in amps is added to the WELD (A).
WELD (A)	✓	✗	✗	✓	WELD (A) current for STICK or LIFT TIG.
ARC CONTROL	✓	✗	✗	✗	Adjusts percentage increase in welding current and is proportional to arc length (arc voltage).
WELD REFERENCE	✗	✗	✓	✗	The welding current and the arc voltage are controlled automatically for an arbitrary frequency.

Table 3-4: Weld Process selection verses Weld Mode

3.04 Weld Parameter Descriptions

3.04.01 WELD (V)

This parameter sets the MIG weld arc voltage in MIG mode.

3.04.02 INDUCTANCE

This parameter sets the INDUCTANCE when MIG welding. It controls the dynamic properties of the arc in dip transfer welding mode. When this parameter is set to 0%, ie minimum inductance, the arc has a fast response with a resulting crisp arc noise and coarse spatter. When this parameter is set to 100%, ie maximum inductance, the arc has a slow response with a resulting soft arc and fine spatter.

NOTE 7

As the INDUCTANCE is increased, the WELD (V) may need to be adjusted to achieve the desired weld characteristic.

3.04.03 HOT START

This parameter operates in STICK mode and improves the start characteristics for stick electrodes, e.g. low hydrogen electrodes. It sets the peak start current on top of the WELD current. For example, when Weld Current = 100 amps & HOT START = 50A, then the HOT START current = 150 amps. Note; HOT START current will not exceed the rated output current of the machine.

3.04.04 WELD (A)

This parameter sets the STICK & Lift TIG weld current.

3.04.05 ARC CONTROL

This parameter operates in STICK mode only and is used to adjust percentage increase in welding current and is proportional to arc length (arc voltage). This control provides an adjustable amount of arc control (or dig). This feature can be particularly beneficial in providing the operator with the ability to compensate for variability in joint fit up in certain situations with particular electrodes, eg cellulose and low hydrogen electrodes. In all welding processes, the amount of penetration obtained is dependent on the welding current; ie the greater the penetration, the greater the current.

Arc Force Position	Current Increase when Arc Voltage is less than 18V	Effect on Welding Performance
Minimum (0)	0A	Soft arc, Low spatter, Low penetration
Medium (20%)	32A	Normal arc, Improved fusion characteristics, Normal penetration
Maximum (100%)	160A	Hard arc, Deep penetration

Table 3-5: Weld Parameter Descriptions

In general, having the ARC CONTROL set at 100% (maximum) allows greater penetration control to be achieved. With the ARC CONTROL set at 0% (minimum) the Power Source has a constant current characteristic. In other words, varying the arc length does not significantly affect the welding current. When the ARC CONTROL set to 100%, it is possible to control the welding current by varying the arc length. This is very useful for controlling penetration on root runs and side wall wash on vertical up fillet welds.

i) Root runs

During root runs the weld pool forms a "keyhole" shape. If too much weld current is used, the hole blows out and the weld collapses. If too little weld current is used, the hole closes up and penetration is lost. The size of the hole also determines the arc length; ie as the hole gets bigger, the arc gets longer. If arc force is used, the increase in the arc length causes the weld current to decrease until the hole starts to close up but if the hole closes up to much then the arc length decreases which causes the weld current to increase. Too little or too much arc force makes this process unstable. The operator must adjust the arc force until a happy medium is reached.

ii) Vertical up welding

When welding vertical up with arc force on, the operator can control the amount of current by changing arc length, ie voltage. Weld metal is deposited by "digging" the electrode into the side of the base metal joint and then increasing the arc length with a flicking motion, to allow the weld pool to freeze, before digging the electrode into the other side of the base metal joint. Without arc force, increasing the arc length does not decrease the weld current sufficiently and the operator has to manually decrease the current via a remote current control to freeze the weld pool. This welding current reduction also reduces the penetration.

The arc force allows the weld pool to freeze during the "flick" phase without decreasing the amount of weld current available during the "dig" phase thus maximizing penetration.

3.05 Weld Parameters for SanRex 400MP

				Weld Mode			
Weld Parameter	**Parameter Range**	**Factory Setting**	**Incremental Unit**	**STICK**	**MIG**	**PULSED MIG**	**LIFT TIG**
WELD (V) MIG	10.0 to 36.0V DC	17.0V	0.1V	✗	✓	✗	✗
INDUCTANCE	0 to 100%	10%	1%	✗	✓	✗	✗
HOT START	0 to 70A	20A	1A	✓	✗	✗	✗
WELD (A) TIG or STICK	5 to 400A DC	80A	1A	✓	✗	✗	✓
ARC CONTROL	0 to 100%	10%	1%	✓	✗	✗	✗
WELD REFERENCE	0 to 440	0	1	✗	✗	✓	✗

Table 3-6: Weld Parameters for SanRex 400MP

3.06 Power Source Features

Feature	Description
Full Digital Control	• Almost all welding parameters are adjustable
Touch Panel Switches	• Touch switches eliminate mechanical damage
Front Control Protection Cover	• Protects front panel controls
Digital Meter	• Displays selected weld parameter value • Displays weld current when welding • Displays weld current for 20 seconds after weld has been completed • A selected weld parameter value can be adjusted at any time even while welding
Intelligent Fan Control	• The intelligent cooling system is designed to reduce dust and foreign material build-up, whilst providing optimum cooling. • Fan speed reduces approximately 30 seconds after machine is turned on • Fan speed increases when internal components reaches operating temperature
ON/OFF Switch	• Mains ON/OFF switch located on rear panel
Voltage Reduction Device (VRD) ***(Shipped de-activated, field capable)*** ***See the VRD Section of this manual for activation instructions.***	Reduces the OCV when the power supply is not in use. Eliminates the need for add on voltage reducers and has no effect on arc starting. • VRD fully complies to IEC 60974-1 • When Stick mode is selected the green VRD light is ON when not welding and red when welding. • When in TIG modes VRD is off.
Control Knob	• For the selected weld parameter, rotating the knob clockwise increases the parameter • Rotating the knob counter-clockwise decreases the parameter • A selected weld parameter value can be adjusted at any time even while welding • Pushing the knob in displays actual arc voltage.
Self Diagnosis Using Error Codes	• An error code is displayed on the Digital Meter when a problem occurs with Primary supply voltage or internal component problems. Refer to troubleshooting guide.
Save/Load function	• A total number of 5 programs can be saved into the 400MP memory. **SAVE the Current Weld Parameters into Memory** • Press and HOLD the *SAVE* button. Beep will sound and Digital Meter display will show a number 1.

Feature	Description
	• Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter. After selecting the desired memory location (ie 1 to 5), press the Forward button and the machine will give a beep to confirm the weld parameters from the control panel are saved. ***LOAD* (retrieve) a Program to Control Panel** • Press and HOLD the *LOAD* button. Beep will sound and Digital Meter display will show a number 1. • Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter. • After selecting the desired memory location (ie 1 to 5), press the Foward button and the machine will give a beep to confirm the weld parameters are loaded onto the control panel.

4.0 SEQUENCE OF OPERATION

NOTE: The Forward and Back Buttons are used to select the parameters to be set. The LED's show which function is being adjusted on the weld sequence graph. Refer to the Symbols Table located in the front of the manual for Symbol descriptions.

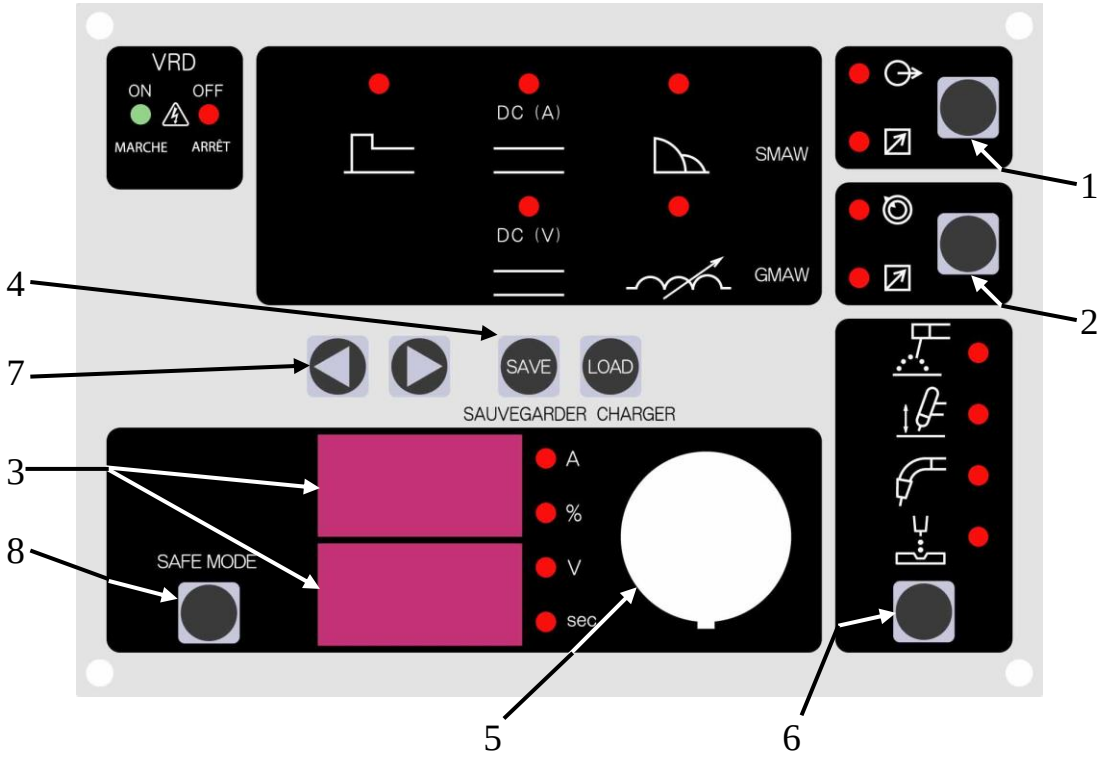


Figure 4-1 SanRex 400MP Front Panel

1. **Contactor Function:** Pressing this buttons enables Contactor functions.
2. **Remote Functions:** Pressing this buttons enables remote current functions.
3. **Digital LED Displays:** Welding amperage, Voltage and parameter values are displayed in this window. Internal warnings such as over temperature, low or high input voltage applied are signaled to the operator by a warning sound and error message on the screen.
4. **Save/Load Buttons:** By using the Save & Load buttons the operator can easily save up to 5 welding parameter programs.
5. **Control Knob:** Allows the operator to adjust the output amperage/voltage within the entire range of the power source, also used to set each parameter value.
6. **Process Button:** This button selects between STICK, Lift TIG, MIG, and Pulsed-MIG modes (standard GMAW and Pulsed-MIG (GMAW-P)).
7. **Forward and Back Buttons:** This button select between HOT START, WELD CURRENT, and ARC CONTROL while in STICK and Lift TIG modes and selects between WELD VOLTAGE and INDUCTANCE CONTROL while in MIG mode. This button is also used in conjunction with the Save/Load buttons to save and load welding programs.

8. **SAFE MODE:** SAFE (Special Application Function Environment) is a mode of operation that the 400MP welding power source can enter in order to customize the welder for special applications. See the SAFE MODE section in this manual for additional information.

4.01 Stick Welding

- Connect work lead to negative terminal
- Connect electrode lead to positive terminal
- Switch machine on
- Set weld current.
- Connect remote control device if required

Use the Forward and Back Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

- Set *HOT START*
- Set *ARC CONTROL*
- Set *WELD* current

Commence welding

4.02 LIFT TIG Welding

Connect work lead to positive terminal

- Connect TIG torch to negative terminal
- Switch machine on
- Set weld current.
- Connect remote control device if required

Use the Forward and Back Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

Commence welding

4.03 MIG Welding

- Connect work lead to negative terminal
- Connect electrode lead to positive terminal
- Switch machine on
- Set weld voltage.
- Set Inductance
- Connect Wire feeder
- Set wire feed speed (IPM)
- Set Arc Length. The meter will display a reference number between 0 and 440. The higher the reference number, the higher the pulse rate and arc voltage. Use the Forward and Back Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

4.04 Pulse-MIG Welding

- Connect work lead to negative terminal.
- Connect electrode lead to positive terminal
- Switch machine on
- Set process to Pulse-MIG mode
- Set Schedule to desired program for application
- Connect Wire Feeder
- Set wire feed speed
- Set Arc Length

The meter will display a reference number between 0 and 440. The higher the reference number the higher the pulse rate and arc voltage. Use the Forward and Back buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the Control knob to adjust each parameter.

Commence welding

See the *Pulsed-GMAW* section in this manual for more information regarding Pulse-MIG operation.

4.05 Save-Load Operation

A total number of 5 programs can be saved into the 400MP memory.

SAVE the Current Weld Parameters into Memory

- Press and HOLD the *SAVE* button. An audible beep will sound and the Digital Meter will display the number "1".
- Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter
- After selecting the desired memory location (ie 1 to 5), press the Forward button and the machine will beep to confirm the weld parameters from the control panel are saved.

***LOAD* (retrieve) a Program to Control Panel**

- Press and HOLD the *LOAD* button. An audible beep will sound and the Digital Meter will display the number "1".
- Select a memory location by rotating the control knob, 1 to 5 is displayed on the meter.
- After selecting the desired memory location (ie 1 to 5), press the foward button and the machine will beep to confirm the weld parameters are loaded onto the control panel.

4.06 Pulsed-GMAW

4.06.01 General

Pulse-GMAW (referred to as Pulse-MIG) is a welding process that involves the pulsing of the welding current from a high value (peak current) to a low value (background current) to produce a clean spatter-free weld. The intent of this manual is not to present a comprehensive coverage of this welding process, but to give an explanation of the terms used and how they apply to the 400MP power source.

4.06.02 Explanation of Terms

Ist: Ist is the amplitude of the initial pulse of current during the arc starting interval.

Ipk: Ipk is the amplitude of the high pulse of welding current (peak current). The current is forced to this high value by the power source for a brief time (Tpeak). The peak current melts the wire and forms a droplet. This droplet is then propelled to the weld pool.

Vpk: Vpk is the amplitude of the arc voltage during the high pulse of weld current.

Tpk: Tpk is the amount of time that is spend at the peak current (Ipk). This time must be sufficient to form a droplet.

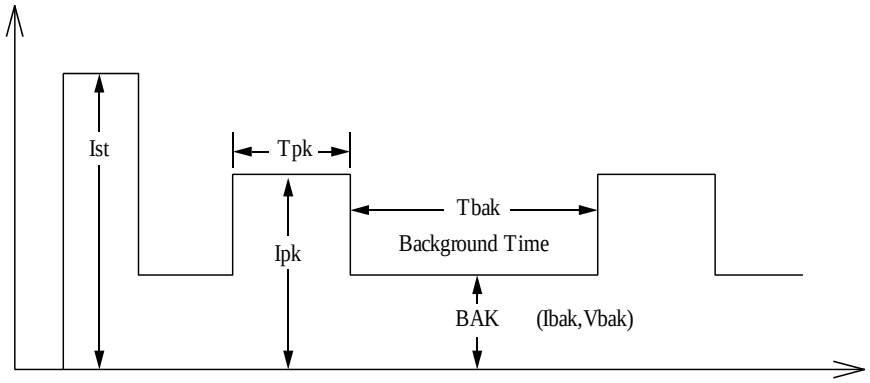


Figure 1 Pluse Waveforms

Ibak: Ibak (background current) is the low value of the weld current. The background current serves to preheat the wire and workpiece. The background current must not be allowed to go too low or the arc become unstable and difficult to maintain.

Vbak: Vbak (background voltage) is the amplitude of the arc voltage during the background time.

Tbak: Tbak (background time) is the amount of time that the weld current is at the low value. Normally, this would be a larger amount of time than is spent at peak current time (Tpk).

Pulse Rate: The pulse rate is the number of pulses of current that is produced per second. The 400MP allows a pulse rate of approximately 30-300 pulses per second.

Pulsing Frequency: Pulsing frequency is the same as pulse rate. A pulse rate of 60Hz means that the power source produces 60 pulses of current per second.

Ibak(min): Ibak(min) refers to a minimum background current level. If the current falls below this minimum level, it becomes difficult to maintain a stable arc.

Arc Length: The distance between the end of the wire electrode (the wire being fed through the torch or gun) and the weld pool. This distance is usually set to give a smooth, spatter-free weld.

4.06.04 Pre-Programmed Pulsed-MIG Welding Schedules

The 400MP Pulse-MIG machine comes with 16 pre-programmed weld schedules for use in the Pulsed-MIG mode, 8 schedules in standard mode and 8 schedules in the user selectable AVC (Automatic Voltage Control) mode. Each schedule was developed around a particular wire/gas combination shown in table 4-1. These schedules were developed to provide good results for most applications. It is possible to use a number of other wire and gas combinations other then those listed in table 4-1. It will be necessary, however, for the user to determine the optimum weld schedule to use.

SCHEDULE NUMBER	WIRE TYPE	WIRE SIZE (INCHES)	Ist (Amps)	Ipk (Amps)	Tpk (Amps)	Vbak (Volts)	Ibak (Amps)	GAS MIXTURE
1	Mild steel	.035	350	300	2.5	20.0	45	92%Ar - 8%CO_2
2	Mild steel	.045	450	350	2.5	20.0		92%Ar - 8% CO_2
3	Stainless Steel	.035	350	276	2.6	18.0		81%Ar - 18%He - 1% CO_2
4	Stainless Steel	.045	400	326	2.8	19.0		81%Ar - 18%He - 1% CO_2
5	Aluminum	.035	400	224	1.4	17.0		100%Ar
6	Aluminum	3/64	450	274	1.4	17.0		100%Ar
7	Metal Core	.045	450	400	1.5	16.0		92%Ar - 8% CO_2
8	Nickel	.035	350	276	2.6	18.0		75%Ar - 25%He
9	Mild steel	.035	350	300	2.5	10	40	92%Ar - 8%CO_2
10	Mild steel	.045	450	350	2.5		55	92%Ar - 8% CO_2
11	Stainless Steel	.035	350	276	2.6		35	81%Ar - 18%He - 1% CO_2
12	Stainless Steel	.045	400	326	2.8		40	81%Ar - 18%He - 1% CO_2
13	Aluminum	.035	400	224	1.4		35	100%Ar
14	Aluminum	3/64	450	274	1.4		40	100%Ar
15	Metal Core	.045	450	400	1.5		35	92%Ar - 8% CO_2
16	Nickel	.035	350	276	2.6		35	75%Ar - 25%He

Table 4-1 Pulse-MIG Schedule for the SanRex 400MP

The standard weld schedules, schedules 1 thru 8, are similar to the AVC schedules, schedules 9-16, but the 8 AVC schedules must be enabled made by actively selecting and enabling the AVC mode in the SAFE (Special Application Function Environment) programming environment. See section 4.07 for SAFE mode functions and operation.

4.06.04 Welding Using the Pre-Programmed Pulsed-MIG Welding Schedules

1. Connect the wire feeder to the power source using the 14-pin socket receptacle on the front of the power source.

2. Connect the welding leads to the power source and wire feeder.

3. Turn AC power switch of the 400MP to the ON position. The initial power up sequence will be complete in approximately ten seconds.

4. Press the Process button of the front control panel to select the Pulsed-MIG process. The light next to the Pulsed-MIG symbol should be illuminated indicating that Pulsed-MIG is now active.

5. To enter the Pulse-MIG Schedule selection mode, press and hold the LOAD button for three seconds until an audible beep is heard. The top digital display will display "Sch" and the bottom digital display will display a schedule number between 1~8 (or 1~16 if AVC has been enabled). See Table 4-1 in this manual for schedule information.

6. For LOCAL control make sure the REMOTE light is off by pressing the REMOTE button if necessary. The light should toggle on and off as the REMOTE button is pressed repeatedly.

7. To set the output, proceed as follows: First, set the wire feed speed at the wire feeder. As in conventional Pulse-MIG welding, the wire feeder will control the average amperage or heat input. Second, set the correct arc length by adjusting the output of the power source. Press the Forward button or Back button to select the voltage as the adjustable value. The meter will display a "reference number" between 0 and 440. The higher the "reference number" the higher the pulsing rate and arc voltage. (The actual number of pulses per second will vary between approximately 30 and 300 as the number varies between 0 and 440.)

   To increase arc length, increase the "reference number" setting. To decrease arc length, decrease the "reference number" setting. This is essentially the same as adjusting voltage for conventional MIG welding. As with conventional MIG welding, the power source must be adjusted to correspond with the correct heat input required for a given wire feed speed setting.

8. For REMOTE control, make sure the REMOTE light is illuminated by pressing the REMOTE button if necessary. Now the arc voltage can be controlled at the wire feeder (if the feeder is equipped with a voltage control). See Step 7 for an explanation of how to set the output of the power source. If the wire feeder is equipped with a digital meter, it will also display the preset "reference number"; however it will show a decimal point. For example, if the wire feeder displays 23.5 the power source will display 235.

9. The power source is now ready to weld. To initiate the weld, activate the torch switch on the MIG torch.

10. To end the weld, release the torch switch. As with conventional MIG welding, a wire conditioning sequence will leave the wire with a very small ball on the end, thus making the next arc strike easier.

4.06.06 Modifying the Pre-Programmed Pulsed-MIG welding schedules

For welding applications where none of the 16 schedules will give adequate results, any or all 16 of the schedules can be modified by the operator to fit the application. In order to change a schedule, an optional **Programming Pendant** is required. By using the optional programming pendant, the characteristics of a schedule can easily be modified.

Optional Programming Pendant use:

1. Turn the power source OFF. To operate properly, the pendant must only be plugged into the power source with the power source turned off.

2. Plug the Programming Pendant into the Programming Pendant connector located on the rear of the 400MP.

3. Turn the power source ON. The initial power up sequence will be complete in approximately ten seconds.

4. Select the PULSED-MIG mode on the front panel.

5. To enter the Pulse-MIG Schedule selection mode, press and hold the LOAD button for three seconds until an audible beep is heard. The schedule number will appear on the pendant.

6. Select the parameter to be adjusted on the pendant. The parameters are Ist, Ipk, Tpk, Vbak and Ibak.

Note 7

Vbak values are only accessible with schedules 1~8 and Ibak values are only accessible with schedules 9~16. Schedules 9~16 are only available when the AVC (Automatic Voltage Control) setting is enabled (on). The AVC setting is only accessible in SAFE mode, option number B. See section 4.07 for SAFE mode operation.

7. Use the INCREASE and DECREASE buttons (or rotate the control knob of the pendant) to adjust the value.

Note 8

It is not the intent of this manual to try to describe how to arrive at the correct values for a "good" schedule. This manual just provides the procedure.

8. Press the SELECT button to advance to the next parameter to be modified.

9. After all parameter have been modified, press the SAVE button on the pendant. This will "permanently" save the new date into the memory on the power source. The new date can still be over-ridden with the programming pendant.

10. To restore the factory setting for the selected schedule, press the RESET button on the pendant.

11. After all changes have been made, the power source should be turned off and the programming pendant removed.

4.07 SAFE MODE (Special Application Function Environment)

SAFE (Special Application Function Environment) is a mode of operation that the 400MP welding power source can enter in order to customize the 400MP for a special applications. In most instances this feature can be ignored. The factory default settings are expected to be sufficient for most users and application. In the few cases that the factory default settings are not adequate, the 400MP can be programmed to meet special specifications.

There are two separate SAFE modes, one for single phase operation and one for three phase operation. These SAFE modes are independent of each other, and are accessed automatically when the machine is powered up in either the single or three phase mode. Any changes to one mode will not affect the other.

The following parameters are programmable in the SAFE mode:

OPTION NUMBER	OPTION	FACTORY DEFAULT		DIPSLAY FORMAT
		1PHASE	3PHASE	
0	**RESET THE SYSTEM (no/rES).** . This option resets all SAFE parameters to their factory default setting. "no" means do not reset the system to factory default while "rES" means reset the system to factory default settings. Only the single phase settings will be reset if the machine is hooked up to single phase power. Likewise, only the three phase setting will be reset when hooked to three phase power. NOTE: THE SAVE BUTTON MUST BE DEPRESSED AND HELD FOR 3 SECONDS WHEN EXITING THE SAFE MODE IN ORDER FOR THE RESET TO OCCUR.	no	no	XX0
1	**WIRE SHARP VOLTAGE SETING.** . This is the voltage that will be present on the wire following a GMAW or Pulsed-GMAW weld. This feature "sharpens" the wire by burning off the ball of filler metal that often forms on the end of the wire following a GMAW weld. The voltage can be set to any value between 0 and 20 volts in increments of 1 volt.	10	10	XX1
2	**WIRE SHARP TIME.** . Wire sharp time is the length of time following a GMAW or Pulsed-GMAW weld that the wire sharp voltage will remain on the filler wire. This variable time is adjustable between 0 and 1.00 second in increments of 0.01 seconds. Longer times will give more of a burn back effect.	0.25	0.25	XX2
3	**MAXIMUM SELECTABLE AMPERAGE.** . Maximum selectable amperage is the largest amperage value that the user is capable of setting in SMAW, Lift GTAW, or GTAW local mode. This feature is effective when the user would like to insure that the amperage is never set above a particular amperage level. The range of values permitted is 5-275 amps (single phase) and 5-400 amps (three phase). The maximum selectable amperage is never permitted to be set less than the minimum selectable amperage.	275	400	XX3

OPTION NUMBER	OPTION	FACTORY DEFAULT		DIPSLAY FORMAT
		1PHASE	3PHASE	
4	**MINIMUM SELECTABLE AMPERAGE.** . Minimum selectable amperage is the lowest amperage value that the user is capable of setting in SMAW, Lift GTAW or GTAW local mode. This feature is effective when the user would like to insure that the amperage is never set below a particular amperage level. The range of values permitted is 5-275 amps (single phase) and 5-400 amps (three phase). The minimum selectable amperage is never permitted to be set greater than the maximum selectable amperage.	5	5	XX4
5	**MAXIMUM SELECTABLE VOLTAGE.** . This voltage is largest value that the user is capable of setting in GMAW local welding mode. Voltages above this value cannot be entered by the user in local mode. This voltage value can be exceeded in remote by using a feeder with voltage setting capability. The range of values permitted is 10.0 ~31.0 volts (single phase) and 10.0 ~ 36.0 volts (three phase). The maximum selectable voltage is never permitted to be set less than the minimum selectable voltage.	31.0	36.0	XX5
6	**MINIMUM SELECTABLE VOLTAGE.** . This voltage is the lowest value that the user is capable of setting in GMAW local welding mode. Voltage below this value cannot be entered by the user in local mode. This voltage value can be overridden in remote by using a feeder with voltage setting capability. The range of value permitted is 10.0 ~ 31.0 volts (single phase) and 10.0 ~ 36.0 (three phase). The minimum selectable voltage is never permitted to be set greater than the maximum selectable voltage.	10.0	10.0	XX6
7	**MAXIMUM SELECTABLE REFERENCE.** . This reference is the largest value that the user is capable of setting in Pulsed-GMAW local welding mode. Reference above this value cannot be entered by the user in local mode. The reference value can be exceeded in remote by using a feeder with voltage setting capability. The ranges of value permitted are between 0 and 440 in increments of 1. The maximum selectable reference is never permitted to be set less than the minimum selectable reference.	440	440	XX7

OPTION NUMBER	OPTION	FACTORY DEFAULT		DIPSLAY FORMAT
		1PHASE	3PHASE	
8	**MINIMUM SELECTABLE REFERENCE.** . Minimum reference is the lowest value that user is capable of setting in Pulsed-GMAW local welding mode. A reference value less than the minimum reference cannot be entered by the user in local mode. This reference value can be overridden in remote by using a feeder with voltage setting capability. Minimum selectable reference can have a range of value between 0 and 440 in increments of 1. The minimum selectable reference is never permitted to be set greater than the maximum selectable reference.	0	0	XX8
9	**LIFT START INITIAL AMPS VALUE.** . The purpose of Lift GTAW is to allow for striking the arc by momentarily touching the electrode to the work piece. The lift circuit functions to reduce the amperage during the arc start to a low level to give a good soft start. This initial start amperage is adjustable between 5 and 100 amps in increments of 1 amp.	20	20	XX9
A	**METER HOLD TIME.** . The hold time is the time following a successful arc that the actual weld amps and volts are held in memory and displayed This parameter is adjustable between 0 and 60 seconds in increments of 1 second. A time of 0 seconds disables meter hold.	5	5	XXA
B	**AVC (on/oFF).** . AVC (Automatic Voltage Control) is available in the 400MP unit only. By turning this function "on", an additional 8 schedules (9-16) are made available in addition to the 8 standard schedules (1-8). AVC Mode (on): Maintains a relatively constant arc length as torch to work distance varies. AVC operates by varying the pulse frequency, which varies the average current. Standard Mode (oFF): A greater variation in arc length as torch to work distance changes providing the operator more control over the arc. This mode can be better for real short arcs and certain wire types where AVC can be too responsive.	oFF	oFF	XXb
C	**LIFT GTAW (on/oFF).** . Lift GTAW (TIG) ON/OFF changes Lift GTAW into standard GTAW. In the "on" setting, Lift GTAW is operational. In the "off" setting, starts will have to be done with an external arc starter or by scratch methods.	on	on	XXC

OPTION NUMBER	OPTION	FACTORY DEFAULT		DIPSLAY FORMAT
		1PHASE	3PHASE	
D	**CODE.** Code is the password code that the user must enter prior to entering the SAFE. The acceptable range of values is between 0 and 999. . NOTE: In the case that you change and forget the code, contact SanRex for instructions on how to access the SAFE and retrieve/change the code.	350	350	XXd
F	**EXIT SAFE WITHOUT SAVING (on/oFF).** This is used to escape the SAFE mode and return to the welding mode. When set to on, the 400MP will exit SAFE mode with no changes made to SAFE parameters saved into memory. This is not a reset of SAFE parameters. For a reset, see SAFE option "0". When set to oFF, the 400MP will exit SAFE mode with all changes made to SAFE parameters saved into memory.	oFF	oFF	XXF

4.07.01 Entering SAFE mode

1. Press the SAFE MODE button on the front panel of the 400MP. Continue to press the button until the meter displays the code “PAS”.

2. SAFE mode is now waiting for the correct password code to be entered. Rotate the Control knob until the correct password code is displayed on the meter display and then press the Forward button. It is only possible to enter the SAFE mode if a correct code is input (or code 350 by factory default). This code insures that inadvertent access to the SAFE mode is not possible. A correct code will cause the 400MP display “1P0” (For 1phase) or “3P0” (For 3phase).

Access to the SAFE mode has now been established. The first two digits in the top digital display, reading left to right, correspond to the number of input power phases detected by the 400MP. It is displayed as "1Px" for 1-phase, and "3Px" for 3-phase input power, where the rightmost digit (shown as “x”) is the option number of the parameter that is currently being set. An explanation and description of these option numbers can be found in the preceding table. The three digits in the bottom digital display correspond to the parameter value. Changes to the displayed parameter value can be made by turning the Control knob.

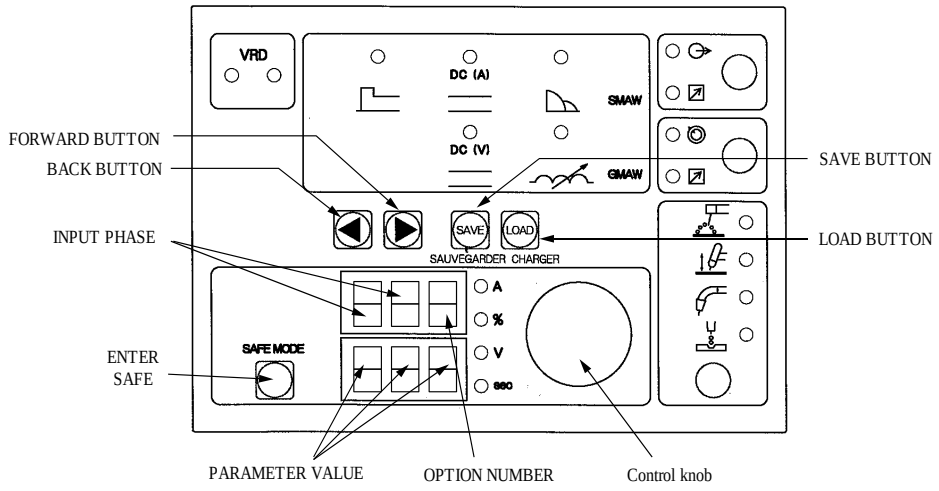


Figure 2

To gain access to the next option number, press the Forward or Back button. At each option proceed as described in the previous paragraph.

4.07.02 Exiting SAFE mode

Failure to properly save the changes will cause all changes to be lost. Powering down prior to saving will also cause all changes made while in SAFE mode to be lost.

1. Press the SAVE button on the front panel of the 400MP. Hold the SAVE button until the meter displays return to standard welding mode display.

2. Once the meter display returns to the standard welding mode display release the SAVE button, the 400MP will provide an audible beep. The 400MP has exited SAFE mode.

Note 9

The changes made to the parameters of SAFE have been stored in memory unless the EXIT SAFE WITHOUT SAVING option was selected before exiting SAFE mode.

5.0 Voltage Reduction Device (VRD)

5.01 VRD Specification

Description	SanRex 400MP	Notes
VRD Open Circuit Voltage	15.3 to 19.8V	Open circuit voltage between welding terminals.
VRD Resistance	148 to 193 ohms	The required resistance between welding terminals to turn ON the welding power.
VRD Turn OFF Time	0.2 to 0.3 seconds	The time taken to turn OFF the welding power once the welding current has stopped.

5.02 Switching VRD On/Off

Switch the machine OFF.

a) Remove the clear plastic cover from the control panel (see Figure 5-1).

- Lift up the cover so it rests on the top of the unit.
- Place a small flat bladed screw driver between the cover hinge on the front panel.
- Gently lift the cover hinge out of the front cover mounting hole.
- Remove the control's clear plastic cover.

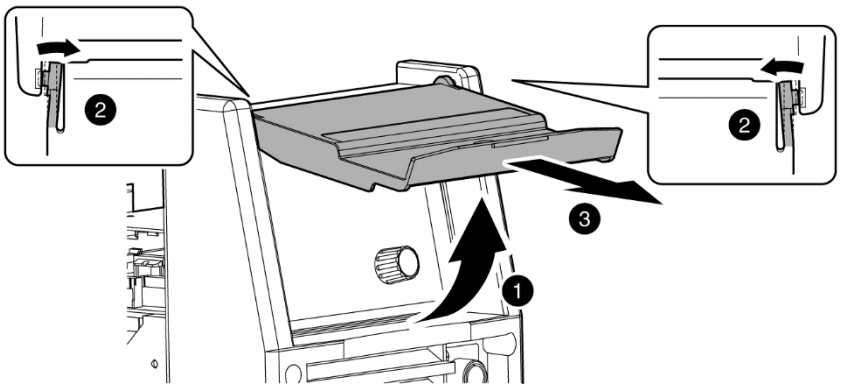


Figure 5-1 VRD ON/OFF Step A

b) Remove four mounting screws from the control panel (see Figure 5-2).

c) Access the VRD control by gently prying back the front panel controls to reveal the VRD on/off potentiometer (see Figure 5-2).

CAUTION 2

Do not pull back the front panel with excessive force as this will unplug the control PCB. Plugging the control PCB back into the front panel controls can only be achieved by removing the side covers.

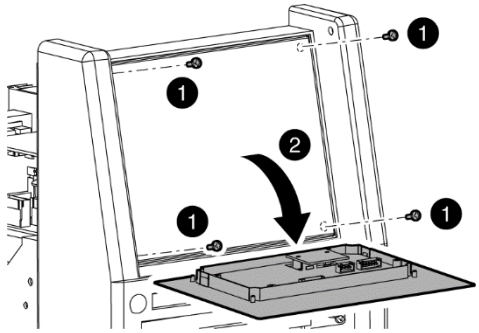


Figure 5-2 VRD ON/OFF Step B, C

d) Turning the VRD ON/OFF (see Figure 5-3).

- To turn VRD ON: rotate the trim potentiometer (VR1) on the display PCB fully clockwise. When VRD is turned ON check that it operates as per VRD Specifications.
- To turn VRD OFF: rotate the trim potentiometer (VR1) on the display PCB fully counter-clockwise.

WARNING 6

The VRD ON/OFF trim potentiometer MUST ONLY be positioned fully clockwise OR fully counter clockwise as the VRD function will be unknown for every other position.

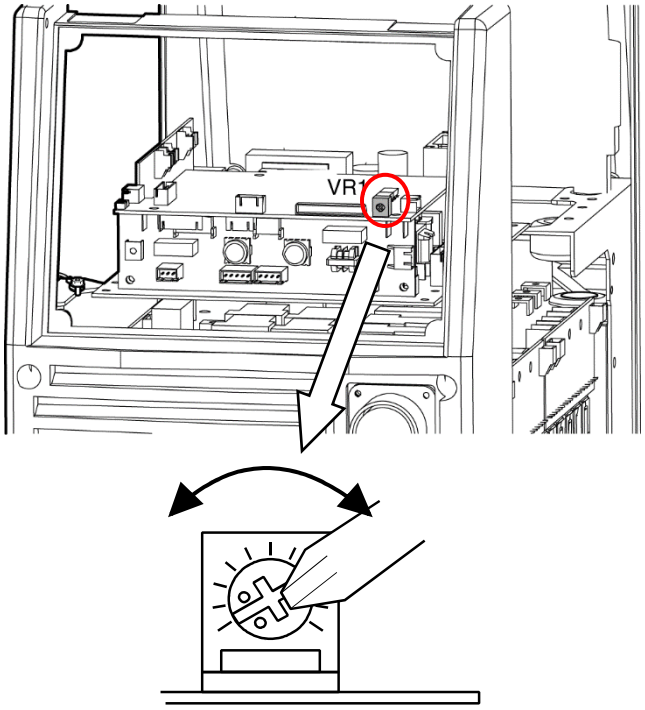


Figure 5-3 VRD ON/OFF Step D

6.0 POWER SOURCE ERROR CODES

Description	Possible Cause	Remedy	Remarks
1 <u>E01 error code displayed</u> Temperature sensor TH1 (protects IGBTs) is greater than 80ºC for about 1 second	A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked	A Let Power Source cool down then keep within its duty cycle. B Have an Accredited SanRex Service Agent investigate C Unblock vents then let Power Source cool down.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E01 resets when TH1 decreases to 70ºC for about 30 seconds.
2 <u>E02 error code displayed</u> Temperature sensor TH2 (protects secondary diodes) is greater than 80ºC for about 1 second	A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked	A Let Power Source cool down then keep within its duty cycle. B Have an Accredited SanRex Service Agent investigate C Unblock vents then let Power Source cool down.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E02 resets when TH1 decreases to 70ºC for about 30 seconds.
3 <u>E03 error code displayed</u> Primary (input) current too high	A Primary current is too high because welding arc is too long. B Mains supply voltage is more than 10% below nominal voltage	A Reduce length of welding arc. B Have an Accredited SanRex Service Agent or a qualified electrician check for low Mains voltage.	Weld current ceases. Buzzer sounds constantly. Switch machine off, wait 3 seconds, and then switch on to reset E03 error.

4	E04 error code displayed Output voltage exceeds the secondary voltage specification	TIG torch cable and/or work lead are too long or leads are coiled.	Reduce the length of the TIG torch cable and/or work lead or un-coiled leads.	Weld current ceases. Buzzer sounds constantly. Switch machine off, wait 3 seconds, and then switch on to reset E04 error.
5	E11 error code displayed Over Primary supply (input) voltage at primary capacitors is exceeded for one second	Primary supply voltage is greater than the nominal voltage plus 10%	Have an Accredited SanRex Service Agent or a qualified electrician check the Primary voltage.	Weld current ceases. Buzzer sounds constantly. Error code E11 automatically will reset when the voltage reduces.
6	E14 error code displayed Under mains supply (input) voltage warning primary capacitors is reduced for one second	Mains supply voltage is less than the nominal operating voltage less 10%.	Have an Accredited SanRex Service Agent or a qualified electrician check the Mains voltage.	Weld current available. Buzzer sounds intermittently. Error code E14 will automatically reset when the voltage increases.
7	E12 error code displayed Under mains supply (input) voltage primary capacitors is reduced for one second	Mains supply voltage is down to a dangerously low level.	Have an Accredited SanRex Service Agent or a qualified electrician check the Mains voltage	Weld current ceases. Buzzer sounds constantly. Error code E12 will automatically reset when the voltage reduces.
8	E81 error code displayed Wrong Primary supply (input) voltage connected	When 3 phase machine is first turned on with the wrong Primary supply (input) voltage connected	Have an Accredited SanRex Service Agent or a qualified electrician check the Mains voltage	No weld current is available. Buzzer sounds constantly. Switch machine off.

9	E82 error code displayed Link switch plug not connected	Link switch plug not connected	Have an Accredited SanRex Service Agent check connector plug on input PCB	No weld current is available. Buzzer sounds constantly. Switch machine off.
10	E83 error code displayed CPU checks mains supply (input) voltage when the on/off switch on rear panel of machine is turned ON.	The Primary supply (input) voltage fluctuates and is not stable.	Have an Accredited SanRex Service Agent check connector plug on input PCB and the Mains voltage	No weld current is available. Buzzer sounds constantly. Switch machine off, wait 3 seconds, and then switch on to reset E83 error.
11	E93 error code displayed Memory chip (EEPROM) on control PCB cannot read/write weld parameters	Memory chip (EEPROM) error	Have an Accredited SanRex Service Agent check the control PCB	Weld current ceases. Buzzer sounds constantly. Switch machine off.
12	E94 error code displayed Temperature sensor TH1 for IGBTs or sensor TH2 for secondary diodes are open circuit	The Welding Power Source's temperature sensors have malfunctioned.	Have an Accredited SanRex Service Agent check or replace the temperature sensors.	Weld current ceases. Buzzer sounds constantly. Switch machine off.
14	E99 error code displayed Mains supply (input) voltage has been turned off but control circuit has power from the primary capacitors	A Main on/off switch on machine has been turned off B Mains supply (input) voltage has been turned off	A Turn on/off switch on. B Have an Accredited SanRex Service Agent or a qualified electrician check the Mains voltage and fuses	Weld current ceases. Buzzer sounds constantly. Switch machine off, wait 3 seconds, and then switch on to reset E99 error.