Pilot Plant since 1959

PATON®

Welding Equipment Pilot-Producing Plant of the E.O.Paton Electric Welding Institute

Operation Manual

Digitally Controlled Semiautomatic Inverter
PSI -160P/200P/250P/250P-400V

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EC Declaration of Conformity

The following products have been tested by us with the listed standards and found in compliance with the European Community Low Voltage Directive 2014/35/EU and Electromagnetic Compatibility Directive 2014/30/EU.

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Manufacturer Address **Limited Liability Company "Pilot Plant of Welding Equipment of Electric Welding Institute named after E.O. Paton"**
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Product: **DIGITAL SEMIAUTOMATIC INVERTER PATON PSI – 200P, PSI – 250P. VDI – 250P-400V**

The statement is based on a single evaluation of one sample of above mentioned products. It does not imply an assessment of the whole production. The manufacturer should ensure that all product in series production are in conformity with the product sample detailed in this report. The applicant should hold the whole technical report at disposal of the competent all the right.

Applied EC Directives: **2014/35/EU (Low Voltage)**
2014/30/EU (Electromagnetic Compatibility)

Applied Standards: **EN 60204-1:2006. Safety of machinery - Electrical equipment of machines – Part 1: General requirements; EN 60974-1:2012 Are welding equipment – Part 1: Welding power sources; EN 60974-10:2014 Are welding equipment – Part 10: Electromagnetic compatibility (EMC) – requirements.**

CE

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We, MASTERWELD Sp. z o. o., hereby declare that specified above conforms covering European Parliament and Council Directives, 2014/35/EC Low Voltage Directive of 26 February 2014 and 2014/30/EU Electromagnetic Compatibility of 26 February 2014.
The CE mark above can be used under the responsibility of manufacturer. After completion of an EC declaration of conformity and compliance with all relevant EU Directives.

WARNING! When connecting the welding unit to the power distribution board (at a temperature of 25 ºC), take into account through-the-wall wiring and the lengths of extension cables.

Electrode diameter for a MMA welding process (mm)	**Set current in MMA and TIG welding processes (A)**	**Electrode wire diameter for a MIG/MAG welding process (mm)**	**Cross-section area of the power cable conductor (mm^2)**	**Maximum cable length (m)**
		PSI-200P		
Φ 3 mm	Not more than 120	Not more than 0.8	1.5 2.0 2.5 4.0 6.0	75 105 130 205 310
Φ 4 mm	Not more than 160	Up to 1.0	2.0 2.5 4.0 6.0	75 95 155 230
Φ 5 mm	Up to 200	Up to 1.0	2.5 4.0 6.0	75 125 185
		PSI-250P		
Φ 3 mm	Not more than 120	Not more than 0.8	1.5 2.0 2.5 4.0 6.0	75 105 130 205 310
Φ 4 mm	Not more than 160	Not more than 1.0	2.0 2.5 4.0 6.0	75 95 155 230
Φ 5 mm Φ 6mm for a free-melting electrode	Up to 250	Not more than 1.2	2.5 4.0 6.0	60 100 150

1. GENETAL INFORMATION

The digitally controlled invertor-rectifier welding units MIG-200P and MIG-250P are designed for direct-current gas-shielded welding according to such welding processes as a manual arc welding process (MMA), an argon arc welding process (TIG), and a semiautomatic arc welding process (MIG/MAG). The digital controller used in these welding units ensures significant advantages for the welding unit as compared with multifunctional analog controllers, as the analog controllers are designed for the specific operating modes of controlled equipment and are not optimal in all operating modes. The digital controller of the MIG welding units allows all the capabilities of the welding unit, up to its capabilities at full power, to be used in all the operating modes of the unit.

The MIG welding units pertain to the Professional Series equipment and are designed for industrial use. The operation of the welding unit is possible separately from an electrode wire feeding unit. This operational mode is reasonable in order to provide the ease of use of the unit and compliance of the unit with safety requirements. The additional adjustment operations provided for the welding unit make it possible to set the optimal values of the operating parameters of the unit in various operating modes characterized by a high load factor at a rated current of up to 200 A or 250 A. The welding units can be used for manual arc welding with standard electrodes 1.6 … 5 mm in diameter and free-melting electrodes up to 6.0 mm in diameter and for semiautomatic arc welding with solid electrode wire 0.6 … 1.2 mm in diameter. The function of reduction of open-circuit voltage in the manual arc welding process (MMA), with the possibility for this function to be switched on and off, allows the welding unit to be operated in unsafe environment.

The distinctive feature of the welding units is the availability of a high-quality electrode wire feeding unit and a KZ-2 euro style connector, which allows the operator to replace welding torches at his option. The welding unit contains a module for protection against excess and low power supply voltage.

Due to the increased frequency of the input voltage of the rectifier transformer of the welding unit, the weight and overall dimensions of the transformer are significantly reduced as compared with other welding units with similar characteristics.

The basic advantages of the PATON™ welding units are the following:

1. The possibility to adjust welding parameters in wide ranges
- **a)** 1 basic parameter + 10 additional parameters for the manual arc welding process (MMA)
- **b)** 1 basic parameter + 8 additional parameters for the argon arc welding process (TIG)
- **c)** 1 basic parameter + 4 additional parameters for the semiautomatic arc welding process (MIG/MAG)

2. The availability of the adjustable pulse welding mode for all the welding processes

3. The welding unit is protected against long-time fluctuations of power supply voltage and ensures welding arc stabilization when the input voltage of the unit changes in the range of 160 V through 260 V. It should be noted that welding at a minimum voltage of 160 V is allowed only by using an electrode not more than 3 mm in diameter for the manual arc welding process, or electrode wire not more than 0.8 mm in diameter for the semiautomatic arc welding process.

4. The welding unit is rated for operation with a standard power supply system. Due to the higher efficiency coefficient of the unit, the power consumed by the unit is reduced by 50 % as compared with other similar welding units.

5. The rotation frequency of the driving motor of the ventilator of the welding unit can be automatically varied depending on the temperature inside the unit. This feature allows the service life of the ventilator and driving motor to be increased and, additionally, dust content inside the unit to be reduced.

6. The welding unit is easy operated due to the optimal operating load factor in operation at the rated current. This feature allows welding to be performed continuously at a temperature of 25 ºC.

7. The enhanced reliability of the welding unit in operation in dusty environment

8. The welding unit contains an electronic thermal protection system for protecting all the heat-generating components of the welding unit against overheating.

9. All the printed-circuit boards with electronic elements are impregnated with two layers of high-quality varnish in order to provide the high reliability of the welding unit within its service life.
10. Improved arc stability

1.1. TECHNICAL CHARACTERISTICS

PARAMETERS	PSI-200P	PSI-250P	PSI-250P-400V
Rated power supply voltage 50/60 Hz, V	230	230	3x400
Rated power supply current	25 … 28 A	32 … 36 A	10 … 12
Rated welding current	200 A	250 A	250
Maximum operating current,	270 A	335 A	335
Operating load factor, %	70 % at 200 A 100 % at 167 A	70 % at 250 A 100 % at 208 A	70 % przy 250 A 100 % przy 208 A
Power supply voltage range	160 … 260 V	160 … 260 V	±20 %
Welding current control range	10 … 200 A	12 … 250 A	12 – 250
Welding voltage control, V range	12 … 28 V	12 … 28 V	12 – 28
Diameter of a stick electrode	1.6 … 5.0 mm	1.6 … 6.0 mm	1,6 – 6,0
Diameter of electrode wire	0.6 … 1.0 mm	0.6 … 1.2 mm	0,6 – 1,2
Welding processes with pulse welding modes	MMA, TIG, MIG/MAG	MMA, TIG, MIG/MAG	MMA; TIG; MIG/MAG
Increased-current arc starting function of the manual arc welding process	Adjustable	Adjustable	Adjustable
Reduced-voltage welding function of the manual arc welding process	Adjustable	Adjustable	Adjustable
Protection against electrode sticking	Automatic	Automatic	Automatic
Reduction of open-circuit voltage	ON/OFF	ON/OFF	ON/OFF
Open-circuit voltage in the manual arc welding process	12/70 V	12/70 V	12 / 70
Welding arc starting voltage	110 V	110 V	110
Rated consumed power	5.5 … 6.1 kVA	6.9 … 7.7 kVA	6.9 … 7.7
Maximum consumed power	6.6 …8.0 kVA	8.5 … 11.0 kVA	8.5 … 11.0
Efficiency coefficient	92 %	92 %	92
Cooling	Forced	Forced	Forced
Operating temperature range	-25 … +45 ºC	-25 … +45 ºC	–25 … +45 ºC
Overall dimensions (length × width × height)	350 × 260 × 270 mm	350 × 260 × 270 mm	360 x 260 x 270
Weight without the coil and accessories	10.6 kg	10.7 kg	10,8
Protection class*	IP 33	IP 33	IP33

The recommended lengths of the welding cables are indicated below.

Cable length (m)	Maximum current (A)	Cross-section area of the cable conductor (mm^2)	Cable designation
1 … 10	Not more than 160	16	KG 1 × 16
2 … 16	Not more than 200	25	KG 1 × 25
3 … 11 m	Up to 200	35	KG 1 × 35

**These Professional Series welding units are protected against ingress of foreign particles more than 2.5 mm in size and against rain drops if the rain drops fall at an angle to the vertical surfaces of the welding unit not more than 60 degrees.*

1.2. CONTROLS AND CONNECTRORS

1. Unit of measurement for the

current displayed parameter:

a) V – volt
b) A – ampere
c) % - percent
d) s – second

2. Digital seven-segment display
3. Buttons for increasing or decreasing the selected parameter value
4. Indicator of the current or selected welding process
5. (5.1, 5.2, 5.3) Button for selecting functions for the current welding process and for switching to the required welding process:

a) Manual covered-electrode arc welding (MMA)
b) Argon arc welding with a no consumable electrode (TIG)
c) Gas-shielded semiautomatic arc welding (MIG/MAG)

6. Indicator of the operating condition of the welding unit (can blink during welding):

a) Continuously lights green when the welding unit is in the operating mode and in the manual arc welding process.
b) Continuously lights yellow when the welding unit is in the standby mode in the manual arc welding process or semiautomatic arc welding process.
c) Continuously lights red when a fault has occurred or the vending unit is overheated in any operating mode.
d) Does not light when the power supply voltage is lower or higher than the rated voltage.

A (+) The bayonet connector socket for connecting:

a) The electrode cable (or the grounding cable in some cases when special electrodes are used for welding) for the manual arc welding process (MMA)
b) Only the grounding cable for the argon arc welding process (TIG)
c) This connector socket is not used in the semiautomatic arc welding process (MIG/MAG)

B (-) The bayonet connector socket for connecting:

a) The grounding cable (or the electrode cable in some cases when special electrodes are used for welding) for the manual arc welding process (MMA)
b) Only the argon gas torch for the argon arc welding process (TIG)
c) The grounding cable for the semiautomatic arc welding process (MIG/MAG)

7. Button “Wire injection” When the button is pressed, only the wire feed is switched on.
8. Adjusting potentiometer for setting electrode feed velocity
9. Button "Gas supply test" When the button is pressed, only the gas supply valve is switched on.
10. KZ-2-euro connector socket for connecting the semiautomatic welding torch
11. Connector for supplying power to the electrode wire feeding unit from an external power source
12. Connector for supplying power to the electrode wire feeding unit from the welding unit
13. Socket for supplying protective gas to the welding torch
14. Indicator of power supply voltage over 260 V (the indicator lights at the instant of time when 260 V is exceeded)
15. Push-button switch for switching on and off the welding unit

2. SETTING THE WELDIGN UNIT INTO OPERATION Setting the welding unit into operation

WARNING! Read Section 15, "Safety instructions", before setting the welding unit into operation.

2.1. PROPER USE

The welding unit is designed for manual covered-electrode arc welding, argon arc welding, and gas-shielded semiautomatic arc welding. Any other use of the welding unit is considered as improper. The manufacturer of the welding unit is not responsible for damages caused by any improper use of the unit.
The use of the welding unit is proper if all the requirements of this Operation Manual are satisfied.

WARNING! Do not use the welding unit to unfreeze pipes.

2.2. REQUIREMENTS FOR INSTALLATION

The welding unit is protected against ingress of foreign particles more than 2.5 mm in size.
The welding unit is allowed for outdoor operation. The internal electrical and electronic elements of the welding unit are protected against moisture but are not protected against atmospheric condensate drops.

WARNING! After completing welding works in hot weather, or completing intensive welding works in any weather, switch off the welding unit only after at least 5 minutes of time required for the electronic elements of the unit to be cooled.

WARNING! When operating the welding unit in cold season, after the unit was switched off and cooled, condensate can be formed inside of the unit, so switch on the welding unit only 3 … 4 hours after the switching off.
For this reason, do not switch off the welding unit if it is anticipated that the unit is to be switched on not later than 4 hours after the switching off.

Install the welding unit so as not to block or cover the ventilation slots on the front and rear panels of the unit. Prevent ingress of metallic particles (for example, when grinding the weld) sucked into the welding unit by the unit ventilator.

WARNING! After fall from a height, the welding unit might be a source of electrical shock. Install the unit on a firm stable surface.

2.3. CONNECTION TO A POWER SUPPLY SYSTEM

The commercial welding unit is rated for an input power supply voltage of 230 V -27/+18 %.

WARNING! If the input power supply voltage of the welding unit exceeds 450 V, the warranty of the manufacturer of the welding unit will be invalid. Such a condition is possible at large unbalance of phase voltages in the standard power supply system or if the welding unit is connected to the power supply system improperly.

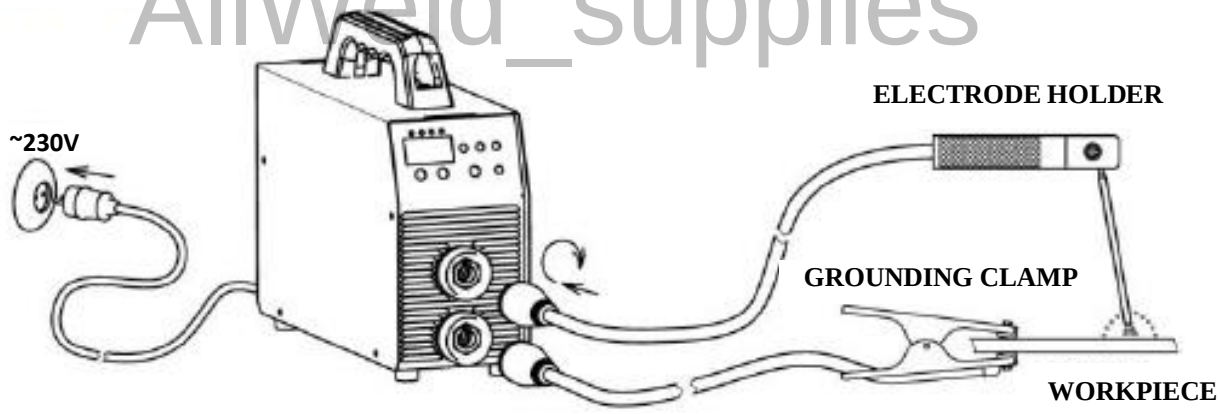
The power supply connector, power cable cross-section area, and supply-line fuses should be selected with consideration for the technical characteristics of the welding unit.

2.4. REQUIREMENTS FOR AN ELECTRICAL OUTLET

WARNING! The parameters of an electrical outlet for the power supply of the welding unit must correspond to the power supply voltage and consumption current of the welding unit (see Section 1.1, "Technical characteristics"). Connect the welding unit to an electrical outlet that is rated for a three-wire plug **with a grounding conductor**.

3. MANUAL COVERED-ELECTRODE ARC WELDING PROCESS (MMA)

3.1. PREPARING THE WELDING UNIT FOR OPERATION

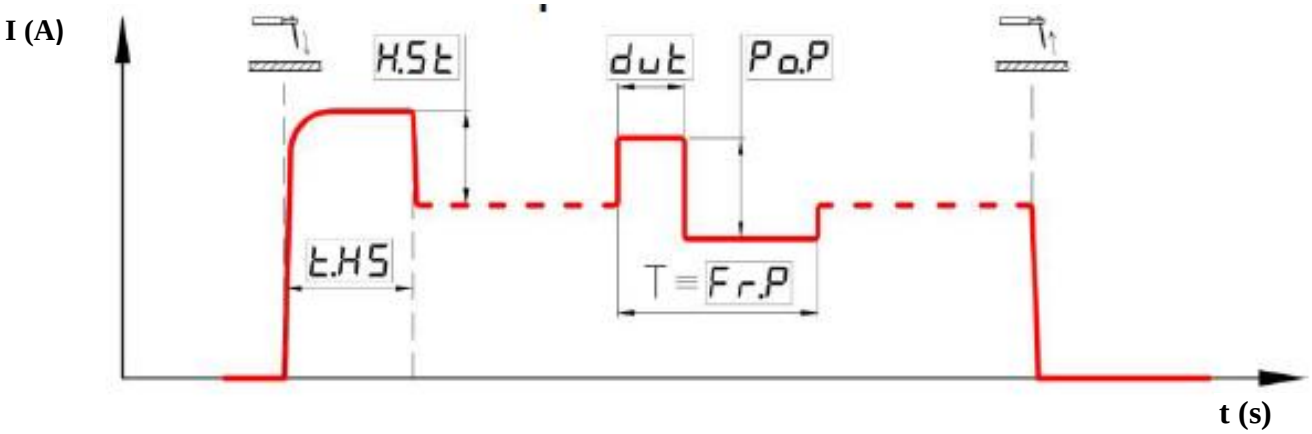


Preparation the welding unit for operation:

1. Insert the plug of the electrode cable into socket **A (+)** of the welding unit.
2. Insert the plug of the grounding cable into socket **B (-)** of the welding unit.
3. Connect the grounding cable to the workpiece.
4. Connect the power cable of the welding unit to the outlet of the power supply system.
5. Set switch 15 on the rear panel of the welding unit to position I (switching on).
6. Press button 5 and hold it not less than 5 s to select the manual arc welding process (MMA). The display of the welding unit will blink, warning the operator that the unit is ready to switch to the next welding process. If the manual arc welding process has been missed during the selection, press and hold button 5 again for sequentially selecting the welding process required.
7. Set the specified welding current by buttons 3.
8. If required, perform the additional functions specified for the manual arc welding process (see Section 6.1).

WARNING! In the manual arc welding process, after switching on the welding unit by switch 15, the welding electrode is under voltage. Do not allow the electrode to contact current-conducting or grounded parts, such as the casing of the welding unit, because such a contact will cause the start of welding.

3.2. OPERATIONAL CYCLE OF THE MANUAL ARC WELDING PROCESS



The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

3.3. INCREASED – CURRENT ARC STARTING

The advantages ensured by the increased-current arc starting function are the following:

- Improved arc starting even when low-quality electrodes are used
- Better joint penetration during arc starting period and, as a result, the lower number of defects associated with incomplete joint penetration.
- Prevention of slag inclusions

Manual adjustment operations: allow the minimum arc starting current to be set in order to decrease power consumption at the stage of arc starting. As a result, the welding arc can be started at the minimum power supply voltage, but in this case, the arc quality characteristics at the stage of arc starting are deteriorated, as the welding unit functions as an arc-welding transformer. Nevertheless, in some conditions, this method of arc starting is the only possible one. The welding current may be increased in order to improve the conditions for arc starting (when the welding unit is connected to a reliable power supply system), but the increased current can cause burn-out when welding thin parts. Therefore, it is recommended to set the minimum arc starting current.

What is achieved by:

During the short time interval of arc starting, the welding current increases by 40 % of the welding current set by default.

Example

Electrode diameter is 3 mm.

Set welding current is 90 A.

The current at the increased-current arc starting stage is $90 + (0.40 \times 90) = 126$ A

The additional adjustment operations allow both the arc starting current **[H.St]** and the arc staring period **[t.HS]** to be varied. Do not set the increased values of these parameters if such increased values are not required, because the operation of the welding unit and reliable arc starting in these conditions are possible only if the welding unit is connected to a high-power system.

The procedure for changing the values of the operational parameters of the welding unit for the current welding process is described in Section 6.1.

3.4. REDUCED – VOLTAGE WELDING MODE

The advantages ensured by the reduced-voltage welding function are the following:

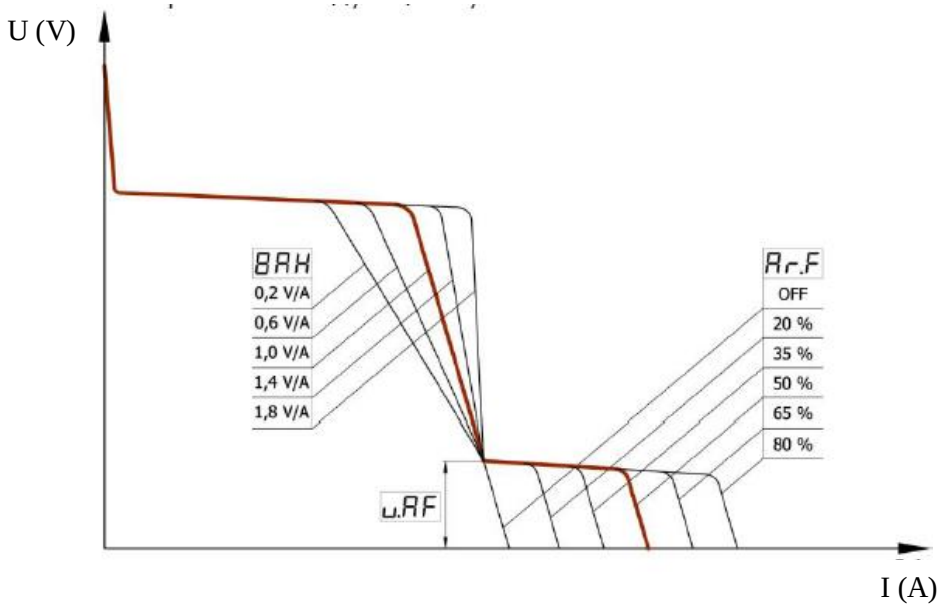
- Improved arc stability in short arc welding mode
- Improved transfer of molten metal drops into the welding pool
- Improved arc starting
- Reduced probability of electrode sticking (see Section 3.5)

Manual adjustment operations allow the minimum welding voltage to be set in order to decrease power consumption and heat input to the weld when welding thin parts. As a result, the probability of burn-out is decreased, but the stability of arc in short arc welding mode is also decreased, as the welding unit functions as an arc-welding transformer. It is possible to increase the voltage reduction percentage to the maximum value in order to improve the stability of arc in short arc welding mode (when the welding unit is connected to a reliable power supply system), but the increased current in this mode can cause burn-out when welding thin parts. Therefore, it is recommended to set the minimum voltage reduction percentage.

How it is achieved:

When the arc voltage drop is lower than the minimum voltage required for stable arcing, the welding current increases by 40 % relative to the set current.

The additional adjustment operations allow both the welding voltage reduction percentage **[Ar.F]** and the voltage reduction period **[u.AF]** to be set. Do not set the increased values of these parameters if such increased values are not required, because in the operation of the welding unit in this condition, specifically in welding with electrodes less than 3.2 mm in diameter, electrode sticking is possible **(see Section 3.5)**.



The procedure for changing the values of the operational parameters of the welding unit for the current welding process is described in Section 6.1.

3.5. PROTECTION AGAINST ELECTRODE STICKING

At the stage of arc starting, the electrode can stick to the workpiece and, as a result, the electrode can be damaged due to overheating.
If the electrode has stuck to the workpiece, the welding current decreases within 0.6 … 0.8 s after the sticking. In this case, the operator can detach the electrode from the workpiece without risk to damage eyes because of random arc starting. After detachment of the electrode, the welding can be continued.

3.6 SETTING THE SLOPE OF THE VOLT-AMPERE CHARACTERISTICK OF THE WELDING UNIT

This function is designed to facilitate welding with electrodes with diverse coatings. By default, the slope of the volt-ampere characteristic **[BAH]** of the welding unit is
1.4 V/A. This value is optimal for the most common electrodes AHO-23 and MP-3 with rutile coating. In order to facilitate welding with electrodes with standard coating (UONI-13/45, LK3-70), it is recommended to set the slope of the volt-ampere characteristic equal to **1.0 V/A**. If electrodes with cellulose coating (TSTS-1, VSTS-4A) are used, the slope of the volt-ampere characteristic should be **0.2 … 0.6 V/A**. In this case, it is sometimes required to increase the threshold value **[u.AF]** for the reduced-voltage welding function to 18 V.

The procedure for changing the values of the operational parameters of the welding unit for the current welding process is described in Section 6.1.

3.7. SHORT ARC WELDING MODE

The short arc welding mode should be used in overhead position welding, when it is required to prevent arc stretching. For this purpose, activate **(ON)** the short arc welding function **[Sh.A]** of the welding unit. By default, the function is deactivated **(OFF).**

The procedure for changing the values of the operational parameters of the welding unit for the current welding process is described in Section 6.1.

3.8. REDUCTION OF OPEN – CIRUCUIT VOLTAGE

When welding works with the manual arc welding process are being performed on vessels, tanks, or other objects with higher requirements for electrical safety, it is reasonable to use the reduction of open-circuit voltage function **[BSn].**
When this function is activated, the output voltage of the welding unit is reduced to the safe value of 12 V within 0.1 s after the detachment of the electrode from the workpiece.
By default, this function is deactivated (OFF), as the reduction of open-circuit voltage impairs arc starting.

The procedure for changing the values of the operational parameters of the welding unit for the current welding process is described in Section 6.1.

3.9. WELDING AT PULSE WELDING CURRENT

This function is designed to simplify the control of a welding process in various spatial welding positions, excluding a flat welding position. This function is also used in welding nonferrous metals. When this function is activated, the application of pulse welding current improves the mixing of molten metals in the weld area and causes forced action on the transfer of molten metal drops into the welding pool, therefore the stability of the weld formation and the stability of the welding process are improved. The pulse welding current in the manual arc welding process affects the weld parameters similar to the movement of the operator hand in manual arc welding process, specifically at hard-to-reach places. The proper adjustment of the welding process parameters in the welding at pulse welding current has a direct effect on the weld quality, specifically reduces weld metal porosity and decreases the graininess of the weld metal. As a result of the improved weld quality, the weld strength increases.

To activate this function, it is necessary to set the following three operational parameters of the welding process: current pulse amplitude **[Po.P],** current pulse frequency **[Fr.P],** and duty cycle **[dut].** By default, the current pulse amplitude is 0 **[OFF],** that is, the function is switched off, the current pulse frequency is 50 Hz, and the duty cycle is 50 %. To activate the function, set the current pulse amplitude **[Po.P]** higher than 0. The current pulse amplitude should be set in percentage of the welding current specified for the welding process.

Example

Welding is to be performed with electrode wire 3.0 mm in diameter.
The set welding current is 90 A.
The current pulse amplitude is 40 %.
The current pulse frequency is 50 Hz (default value).
The duty cycle is 50 % (default value).

The result is the following: the welding current pulse amplitude will be in the range of 54 … 126 A, the current pulse frequency will be 50 Hz, and the current pulse length will be equal to the length of an interval between pulses. If the duty cycle is not equal to 50 %, the current pulses will be nonsymmetrical relative to the intervals between pulses, but the average welding current value will be equal to the set welding current value of 90 A. As a result, the average heat input to the weld will not change.

If it is required to reduce heat input to the weld, as in welding thin parts, the welding current should be decreased by performing the standard setting operations. In this case, current pulse parameters will be adjusted automatically according to the set welding current, and the operator can control the reduction of the heat input, as compared with the heat input at the initial welding current, by simultaneously varying the current pulse amplitude and duty cycle.

The aforementioned parameters should be set differently for different welding processes, depending on the requirements of the operator.

Operations required to set these parameters for the current welding process are described in Section 6.1.

4. ARGON ARC WELDING PROCESS (TIG)

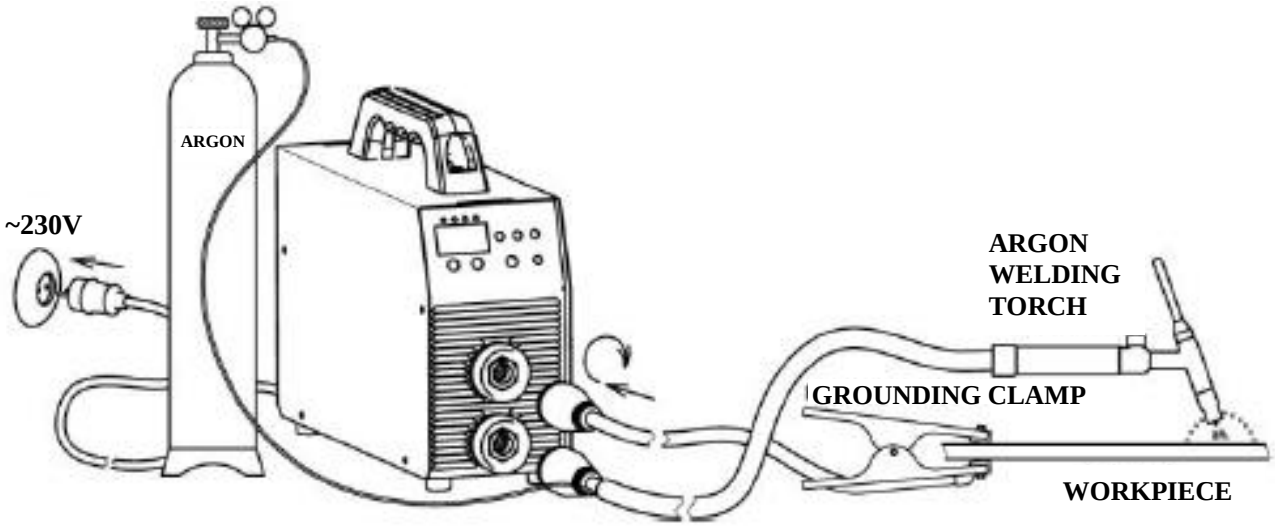
WARNING! As a protective gas in argon arc welding, such inert gas as argon (Ar), sometimes helium (He), or a gas mixture, such as 40 % Ar + 60 % He, is used. **Do not use combustive gases**. The use of other gases is allowed only by agreement with the manufacturer of the welding unit.

WARNING! Do not sharpen the electrode tip to a needle-like shape, as such a shape can cause deviation of a welding arc from side to side. The properly sharpened electrode tip should have a slightly blunted end with a diameter corresponding to the specified welding current. In welding with a large welding current, the high-sharpened electrode easily melts due to insufficient heat

dissipation. The sharpening marks should be arranged along the electrode centerline.

4.1. PREPARING THE WELDING UNIT FOR OPERATION

4.1.2. ARGON ARC WELDING PROCESS WITH TIG-LIFT FUNCTION



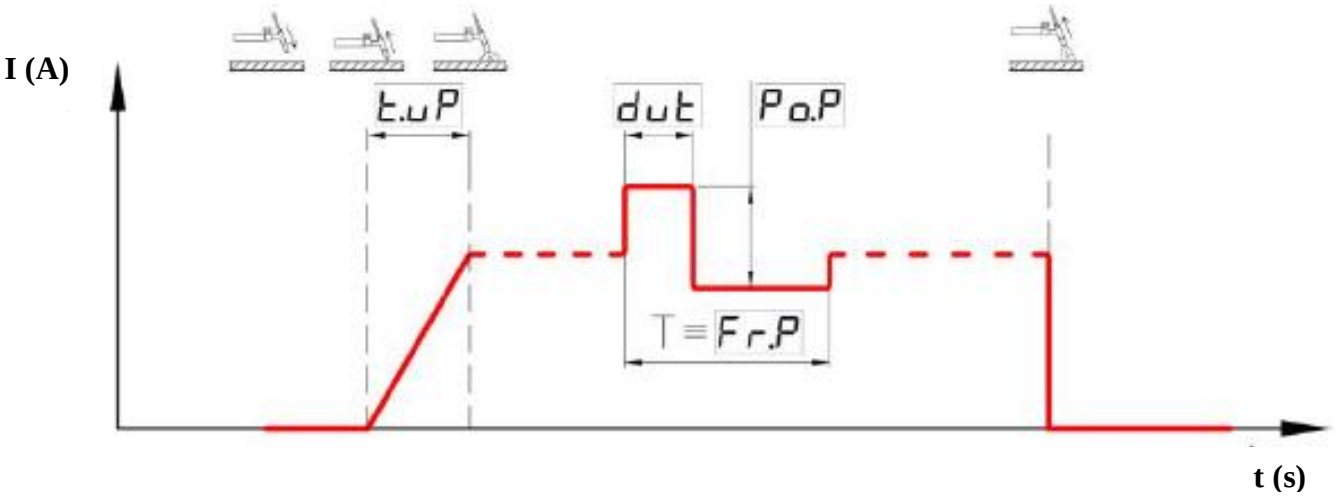
Preparation the welding unit for operation:

1. Connect the power cable of the argon gas torch to connector socket B (-).
2. Connect the grounding cable to connector socket A (+).
3. Connect the grounding cable to the workpiece.
4. Connect the pressure reducer to the fitting of the cylinder with protective gas.
5. Connect the gas hose from the welding torch to the pressure reducer of the gas cylinder.
6. Open the shut-off valve of the gas cylinder. Check the tightness of the connection with the gas cylinder.
7. Connect the power cable of the welding unit to the outlet of the power supply system.
8. Set switch 15 on the rear panel of the welding unit to position I (switching on).
9. Press button 5 and hold it not less than 5 s to select the argon arc welding process **(TIG).** The display of the welding unit will blink, warning the operator that the unit is ready to switch to the next welding process. If the argon arc welding process has been missed during the selection, press and hold button 5 again for sequentially selecting the welding process required.
10. Press button 5 and hold it until **[But]** indication is displayed for selecting the **TIG-LIFT** contact arc starting function of the button on the welding torch. When button 5 is released, after 1 s, the display will show the value of the current function. Set value [**LFt]** by buttons 3. If the **TIG-LIFT** contact arc starting function has been missed during the selection, press and hold button 5 again for sequentially selecting the function required.
11. Set the specified welding current by buttons 3.

If required, perform the additional functions specified for the argon arc welding process (see Section 6.1).

WARNING! Use a gated welding torch with a 13 mm bayonet connector. Select the maximum current of the welding torch according to the specifications.

4.1.3. OPERATIONAL CYCLE OF THE ARGON ARC WELDING PROCESS WITH TIG-LIFT FUNCTION



The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.1.4. TIG-LIFT CONTACT ARC-STARTING FUNCTION

This function of the control button on the welding torch is set by default and is designed for welding torches with contact arc starting, without using oscillators and other like devices. In contrast to conventional methods of arc starting, the contact arc starting prevents the formation of current surge at the instant of the arc starting. As a result, disintegration of the no consumable tungsten electrode and ingress of the electrode particles into the weld can be prevented.

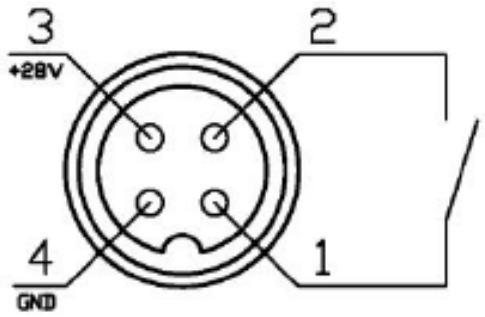
When this function has been activated, contact the electrode with the workpiece. It is allowed to hold the electrode in this position for an unlimited length of time. When the operator is ready to welding (for example, when the operator has lowered the protective shield and purged the weld area with gas), it is necessary to lift the electrode tip slowly from the workpiece. The welding unit will sense this action as a signal to start welding, and the welding current will be linearly increased to the set value. To prevent surface melting of the electrode tip, the rate of lifting the electrode should correspond to the set welding current value. The period **[t.uP]** of linear current rise is discussed **in Section 4.6**.

4.2. ARGON ARC WELDING PROCESS WITH TIG-2T FUNCTION

4.2.1. PREPARING THE WELDING UNIT FOR OPERATION

The procedure for preparing the welding unit for operation with an external oscillator is an individual one and should be described in the oscillator operation manual. The connector for remote switching on and off the welding unit is located on the rear panel of the welding unit. Use only contacts 1 and 2 of the connector. Do not confuse contacts 1 and 2 with contacts 3 and 4, as these contacts are designed for powering the electrode wire feeding unit. When contacts 3 and 4 are cross-circuited, the electrode wire feeding unit will be damaged.

WARNING! If this connector is not used, cover it in order to prevent contamination.

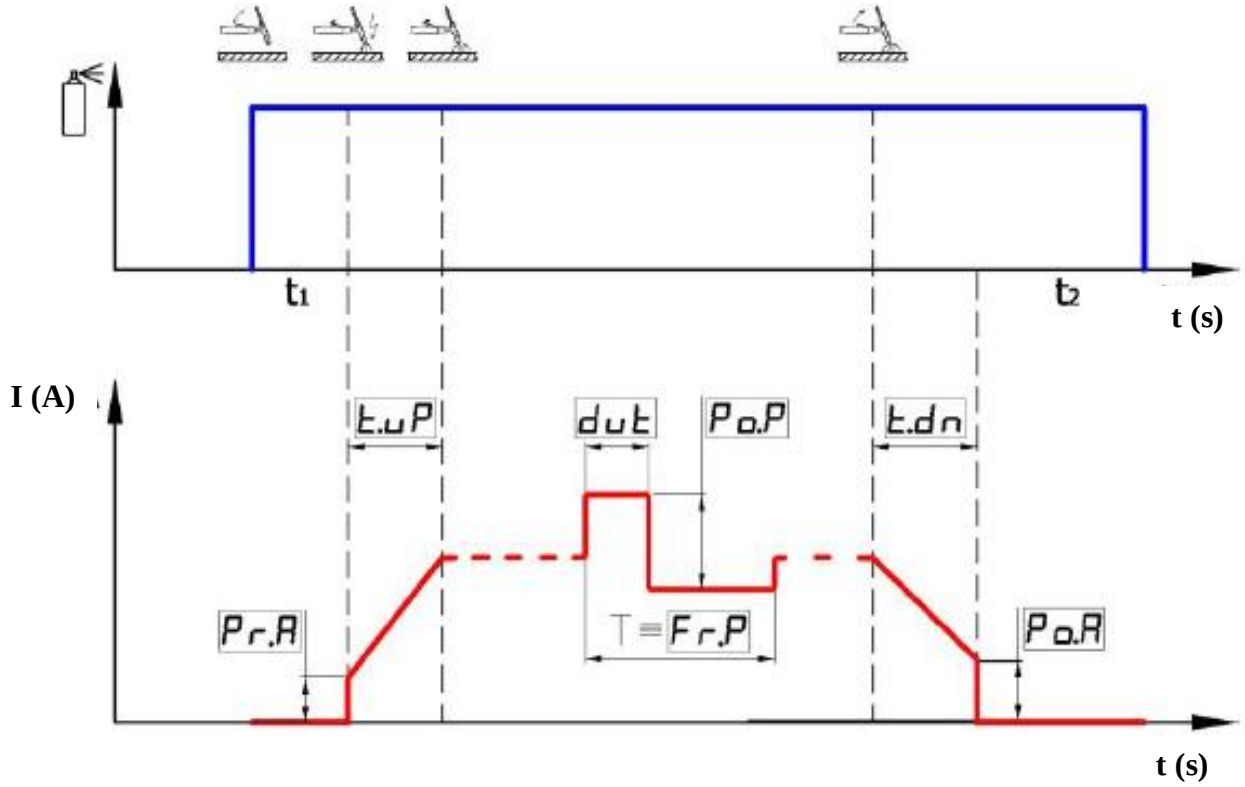


1. Switch on the oscillator for contactless arc starting.
2. Set switch 15 on the rear panel of the welding unit to position I (switching on).
3. Press button 5 and hold it not less than 5 s to select the argon arc welding process (TIG). The display of the welding unit will blink, warning the operator that the unit is ready to switch to the next welding process. If the argon arc welding process has been missed during the selection, press and hold button 5 again for sequentially selecting the welding process required.
4. Press button 5 and hold it until [But] indication is displayed for selecting the TIG-2T contactless arc starting function of the button on the welding torch. When button 5 is released, after 1 s, the display will show the value of the current function. Set value [2t] by buttons 3. If the TIG-2T contactless arc starting function has been missed during the selection, press and hold button 5 again for sequentially selecting the function required.
5. Set the specified welding current by buttons 3.

If required, perform the additional functions specified for the argon arc welding process (see Section 6.1).

WARNING! Use a gated welding torch with a 13 mm bayonet connector. Select the maximum current of the welding torch according to the specifications.

4.2.2. OPERATIONAL CYCLE OF THE ARGON ARC WELDING PROCESS WITH TIG-2T FUNCTION



The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.2.3. TIG-2T CONTACTLESS ARC STARTING FUNCTION

This function of the control button on the welding torch is used if the welding unit is connected to an external module for contactless arc starting (an oscillator) with an integrated gas supply valve.
The control button on the welding torch is connected directly to the oscillator. When the control button is pressed, the control signal is generated and transmitted to the oscillator. On this control signal (moment of time t1), the gas supply valve will be opened for purging the weld area with gas before welding, the welding unit will be switched on, with delay, and a high-voltage pulse for the contactless arc starting will be generated. After these operations, all other functions, specified with consideration for the operational cycle of this welding process, will be performed (see the sections presented below).
When the button is released, the welding current will decrease linearly, the welding unit will be switched off (instant of time t2), and the weld area will be purged with gas. After these operations, the gas supply valve will be closed.

WARNING! The oscillator must contain a device for protecting the output of the welding unit against electric breakdown caused by a high-voltage discharge generated at the instant of time of arc starting. Before the operation, activate the protective device.

4.3. ARGON ARC WELDING PROCESS WITH TIG-4T FUNCTION

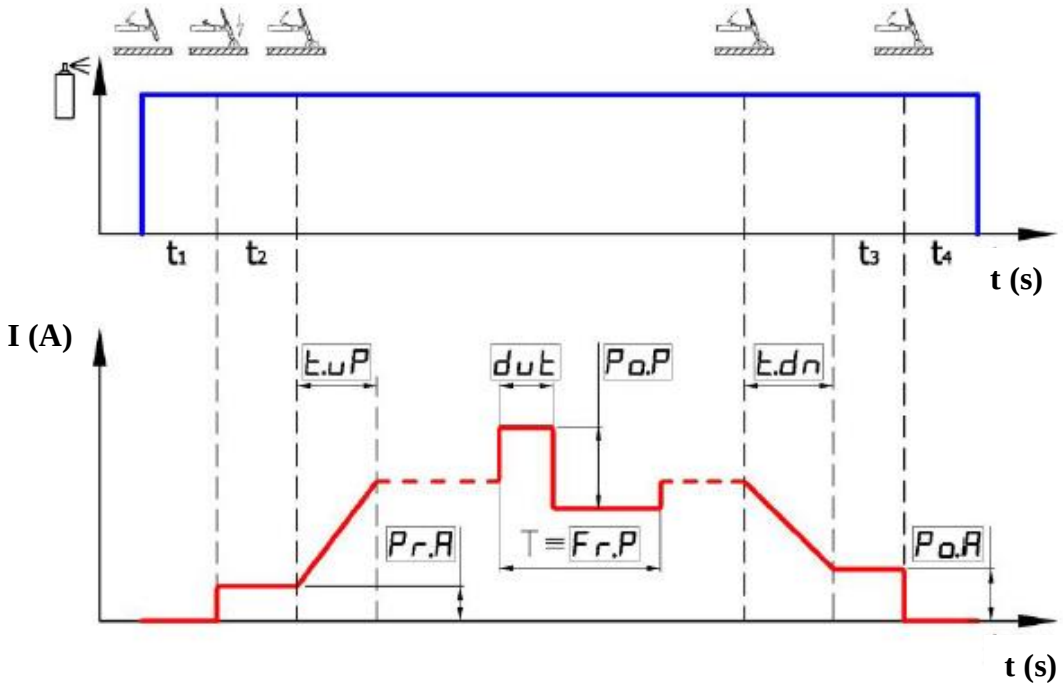
4.3.1. PREPARING THE WELDING UNIT FOR OPERATION

The procedure for preparing the welding unit for operation with an external oscillator is an individual one and should be described in the oscillator operation manual. The connector for remote switching on and off the welding unit is located on the rear panel of the welding unit. The connection diagram for the remote switching on and of the welding unit is the same as for the TIG-2T welding process **(see Section 4.3.1).**

1. Switch on the oscillator for contactless arc starting.
2. Set switch 15 on the rear panel of the welding unit to position I (switching on).
3. Press button 5 and hold it not less than 5 s to select the argon arc welding process (TIG). The display of the welding unit will blink, warning the operator that the unit is ready to switch to the next welding process. If the argon arc welding process has been missed during the selection, press and hold button 5 again for sequentially selecting the welding process required.
4. Press button 5 and hold it until [But] indication is displayed for selecting the TIG-4T contactless arc starting function of the button on the welding torch. When button 5 is released, after 1 s, the display will show the value of the current function. Set value [4t] by buttons 3. If the TIG-4T contactless arc starting function has been missed during the selection, press and hold button 5 again for sequentially selecting the function required.
5. Set the specified welding current by buttons 3.
6. If required, perform the additional functions specified for the argon arc welding process **(see Section 6.1).**

WARNING! Use a gated welding torch with a 13 mm bayonet connector. Select the maximum current of the welding torch according to the specifications

4.3.2. OPERATIONAL CYCLE OF THE ARGON ARC WELDIGN PROCESS WITH TIG-4T FUNCTION



The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.3.3. TIG-4T CONTACTLESS ARC STARTING FUNCTION

This function of the control button on the welding torch is used if the welding unit contains an external module for contactless arc starting (oscillator) with an integrated gas supply valve.
The control button on the welding torch is connected directly to the oscillator. When the control button of the welding torch is pressed, this function is performed in such a manner as the TIG-2T contactless arc starting function **(see Section 4.2.3),** but with two differences.
According to the first difference, at the start of welding, when the control button is held down (t1) after the first pressing, the weld area has been purged with gas before welding, and the high-voltage arc starting has been provided, the initial current (for forming a pilot arc) is constant (instant of time t2), and only when the button is released, the welding current will increase to the set operational current value. Therefore, the button is not to be pressed during the welding with the set operational current.
According to the second difference, at the end of the welding, when the control button is held down (instant of time t3) after the second pressing, the welding current will decrease linearly to the crater welding current value and then is constant until the button is released. When the button is released, the welding current will decrease linearly, the welding unit will be switched off (instant of time t4) and the weld area will be purged with gas. After these operations, the gas supply valve will be closed.

WARNING! The oscillator must contain a device for protecting the output of the welding unit against electric breakdown caused by a high-voltage discharge generated at the instant of time of arc starting. Before the operation, activate the protective device.

4.4. INITIAL CURRENT (PILOT ARC CURRENT) SETTING

This function facilitates the arc starting in a welding process with the use of a welding torch. The function allows the welding process to be started at low welding current, which only support the welding process without increasing heat input to the weld and without burning through the workpiece. In the TIG-4T welding process, it is reasonable to heat the weld area before welding. By default, the initial current value is 15 A.

The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.5. LINEAR INCREASE OF WELDING CURRENT

This function provides the economic consumption of an electrode, promotes the extension of the service life of the welding torch, and facilitates the use of the welding torch. This function prevents the spillage of molten metal in the welding pool. Additionally, during the period **[t.uP]** of linear increase of the welding current, it is possible to accurately locate the welding torch in the weld area, as the arc starting point is initially not always is located in the weld area. It is reasonable to heat the weld area. By default, the period of linear increase of welding current is 1.0 s.

The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.6. LINEAR DECREASE OF WELDING CURRENT

This function is designed for smooth welding of a welding crater, which can be formed in the welding pool due to electromagnetic blow forces generated by the welding arc. The crater so formed can be a source of future welding defects. By default, the period **[t.dn]** of linear decrease of welding current is 3.0 s and can be varied by the operator at his option.

The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.7. CRATER WELDING CURRENT

This function is designed for decreasing the welding current at the end of welding. The decrease of welding current is required for welding a crater at the end of the weld. To activate the function for the TIG-4T welding process, press and hold the button of the welding torch for the second time. By default, the crater welding current is 20 A.

The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

4.8. WELDING AT PULSE WELDING CURRENT

This function is designed to simplify the control of a welding process in various spatial welding positions, excluding a flat welding position. This function is also used in welding nonferrous metals. When this function is activated, the application of pulse welding current improves the mixing of molten metals in the weld area and causes forced action on the transfer of molten metal drops into the welding pool, therefore the stability of the weld formation and the stability of the welding process are improved. The pulse welding current in the manual arc welding process affects the weld parameters similar to the movement of the operator hand in manual arc welding process, specifically at hard-to-reach places.

The proper adjustment of the welding process parameters in the welding at pulse welding current has a direct effect on the weld quality, specifically reduces weld metal porosity and decreases the graininess of the weld metal. As a result of the improved weld quality, the weld strength increases.

To activate this function, it is necessary to set the following three operational parameters of the welding process: current pulse amplitude **[Po.P]**, current pulse frequency **[Fr.P]**, and duty cycle **[dut]**. By default, the current pulse amplitude is 0 **[OFF],** that is, the function is switched off, the current pulse frequency is 5 Hz, and the duty cycle is 50 %. To activate the function, set the current pulse amplitude **[Po.P]** higher than 0. The current pulse amplitude should be set in percentage of the welding current specified for the welding process.

Example

Welding is to be performed with welding nonconsumable tungsten electrode 2.0 mm in diameter.
The set welding current is 100 A.
The current pulse amplitude is 30 %.
The current pulse frequency is 5 Hz (default value).
The duty cycle is 50 % (default value).

The result is the following: the welding current pulse amplitude will be in the range of
70 … 130 A, the current pulse frequency will be 5 Hz, and the current pulse length will be equal to the length of an interval between pulses. If the duty cycle is not equal to
50 %, the current pulses will be nonsymmetrical relative to the intervals between pulses, but the average welding current value will be equal to the set welding current value of 100 A. As a result, the average heat input to the weld will not change.

If it is required to reduce heat input to the weld, as in welding thin parts, the welding current should be decreased by performing the standard setting operations. In this case, current pulse parameters will be adjusted automatically according to the set welding current, and the operator can control the reduction of the heat input, as compared with the heat input at the initial welding current, by simultaneously varying the current pulse amplitude and duty cycle.

The aforementioned parameters should be set differently for different welding processes, depending on the requirements of the operator.

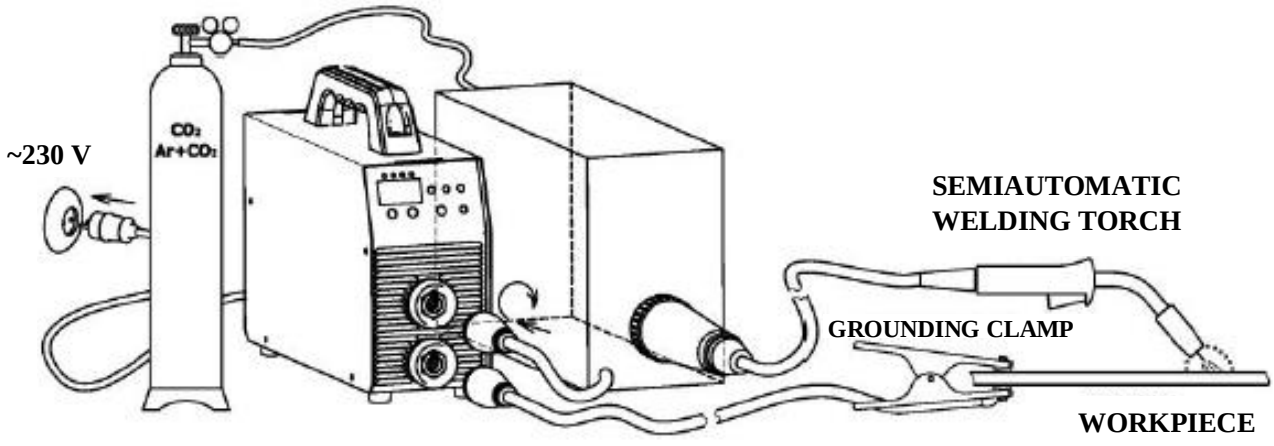
Operations required to set these parameters for the current welding process are described in Section 6.1.

5. SEMIAUTOMATIC ARC WELDING PROCESS (MIG/MAG)

WARNING! As a protective gas, carbon dioxide (CO_2) should be used in welding ferrous metals, only such inert gas as argon (Ar) or, sometimes, helium (He) should be used in welding aluminum, and a gas mixture, such as 70 % Ar + 30 % CO_2, should be used in welding stainless steels and high-alloy steels. The use of other gases is allowed only by agreement with the manufacturer of the welding unit.

WARNING! As in the welding unit a standard KZ-2 euroconnector for a welding torch is used, any welding torch can be purchased at the option of the user

5.1. PREPARING THE WELDING UNIT FOR OPERATION



Preparing the welding unit for operation:

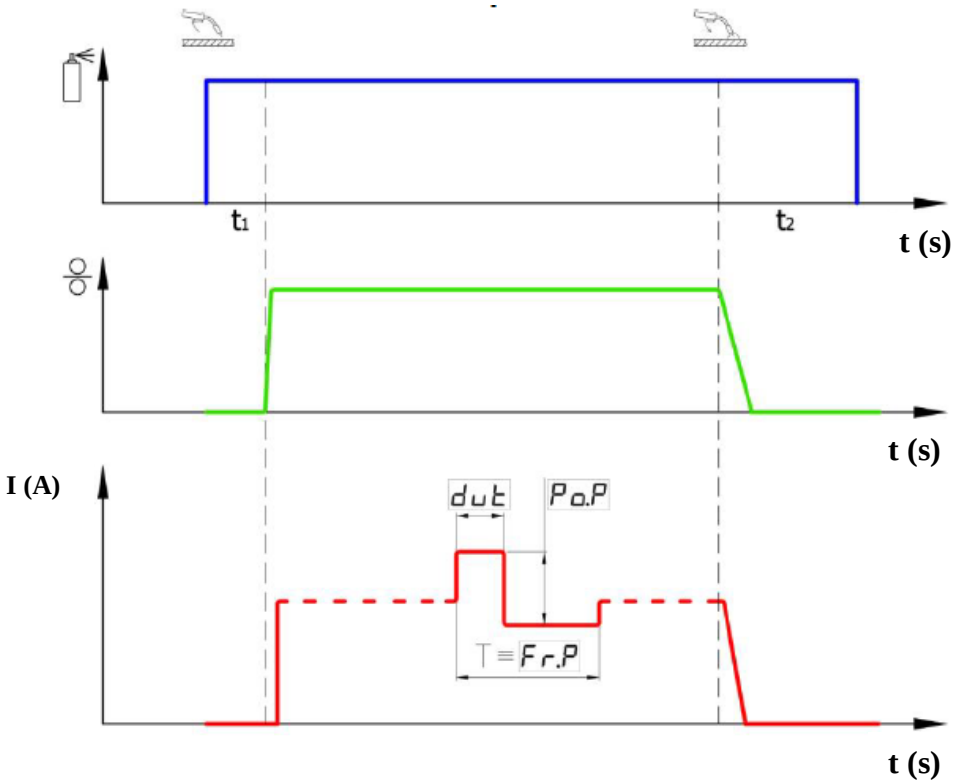
1. Install the welding unit on the base surface of the electrode wire feeding unit and fasten the welding unit by using a strap passed through the slots in the side panels of the welding unit. The strap is supplied together with the welding unit.
2. Connect the cable from the wire feeding unit to socket 12 on the rear panel of the welding unit.
3. Insert the plug of the grounding cable into socket B (-) of the welding unit.
4. Connect the grounding cable to the workpiece.

5. Connect the jumper cable to socket A (+) of the welding unit and to power terminal 11 of the electrode wire feeding unit.
6. Connect the welding torch for semiautomatic arc welding to socket 10 of the electrode wire feeding unit.
7. Connect the pressure reducer to the cylinder with CO_2 or Ar + CO_2 protective gas.
8. Connect the gas hose to the pressure reducer of the gas cylinder and fitting 13 on the rear panel of the electrode wire feeding unit.
9. Open the shut-off valve of the gas cylinder. Check the tightness of the connection with the gas cylinder.
10. Connect the power cable of welding unit to the outlet of the power supply system.
11. Set switch 15 on the rear panel of the welding unit to position I (switching on).
12. Press button 5 and hold the button not less than 5 s to select the semiautomatic arc welding process(MIG/MAG). The display of the welding unit will blink, warning the operator that the unit is ready to switch to the next welding process. If the semiautomatic arc welding process has been missed in the process of selection, press button 5 again for sequentially selecting the welding process required.
13. Set the specified welding voltage by buttons 3.
14. Check the supply of gas by pressing the corresponding button "Gas supply test" of the wire feeding unit.
15. Set the specified electrode wire feed velocity by the corresponding adjusting potentiometer of the electrode wire feeding unit.

If required, perform the additional functions specified for the semiautomatic arc welding process (see Section 6.1).

Do not forget to provide the supply of protective gas. If you have no experience in setting optimal gas pressure for welding the specific parts, first set the pressure so that it exceeds the expected optimal pressure by about 0.2 MPa. In this mode, the increased pressure will not affect the welding process and will only induce the increased consumption of protective gas. In the future, fulfill the general instructions concerning semiautomatic arc welding. For welding with any electrode wire diameter in the range of 0.6 … 1.2 mm, set the medium electrode wire feed velocity of 7 … 10 m/min and the medium welding voltage of about 19 V. Notwithstanding that these parameters are not optimal, they are sufficient for welding if the stable and uniform wire feed is provided. In order to achieve better results, set the optimal welding voltage, by buttons 3, and electrode wire feed velocity by adjusting potentiometer 8 according to the general instructions on semiautomatic arc welding. Remember that the parameters to be set are different for different welding processes.

5.2. OPERATIONAL CYCLE OF THE SEMIAUTOMATIC ARC WELDIGN PROCESS



The procedure for changing the values of the operational parameters of the welding unit is described in Section 6.1.

5.3. MODULATED REDUCTION OF WELDING VOLTAGE AT THE END OF THE WELDING PROCESS

This function is designed for the smooth welding of a welding crater, which can be formed in the welding pool due to electromagnetic blow forces generated by the welding arc. The crater so formed can be a source of future welding defects. This function should be activated by releasing the corresponding button on the welding torch at the end of the welding process. After this, the movement of the welding torch should be terminated, and the welding crater should be welded in the welding voltage decay mode. The default voltage modulated reduction period **[t.dn]** is 1.0 s and can be varied by the operator at his option **(see Section 6 .1).**

5.4. WELDING AT PULSE WELDING VOLTAGE

This function is designed to simplify the control of a welding process in various spatial welding positions, excluding a flat welding position. This function is also used in welding nonferrous metals. When this function is activated, the application of pulse welding voltage improves mixing of molten metals in the weld area and causes forced action on the transfer of molten metal drops into the welding pool, therefore the stability of the weld formation and the stability of the welding process are improved.

The pulse welding voltage in the manual arc welding process affects the weld parameters similar to the movement of the operator hand in a manual arc welding process, specifically at hard-to-reach places. The proper adjustment of the welding process parameters in the welding at pulse welding current has a direct effect on the weld quality, specifically reduces weld metal porosity and decreases the graininess of the weld metal. As a result of the improved weld quality, the weld strength increases.

To activate this function, it is necessary to set the following three operational parameters of the welding process: voltage pulse amplitude **[Po.P],** voltage pulse frequency **[Fr.P],** and duty cycle **[dut].** By default, the voltage pulse amplitude is 0 **[OFF],** that is, the function is switched off, the voltage pulse frequency is 20 Hz, and the duty cycle is 50 %. To activate the function, set the voltage pulse amplitude **[Po.P]** higher than 0. The voltage pulse amplitude should be set in percentage of the welding voltage specified for the welding process.

Example

Welding is to be performed with electrode wire 0.8 mm in diameter.
The set wire feed velocity is 5.5 m/min.
The set welding voltage is 18 V.
The voltage pulse amplitude **[Po.P]** is 20 %.
The voltage pulse frequency **[Fr.P]** is 20 Hz (default value).
The duty cycle **[dut]** is 50 % (default value).

The result is the following: the welding pulse voltage amplitude will be in the range of 14.4 … 21.6 V. the welding voltage pulse frequency will be 20 Hz, and the pulse length will be equal to the length of an interval between pulses. If the duty cycle is not equal to 50 %, the pulses will be nonsymmetrical relative to the intervals between pulses, but the average welding value will be equal to the set welding voltage of 18 V. As a result, the average heat input to the weld will not change.

If it is required to reduce heat input to the weld, as in welding thin parts, the welding voltage should be decreased by performing the standard setting operations. In this case, voltage pulse parameters will be adjusted automatically according to the set welding voltage, and the operator can control the reduction of the heat input as compared with the preceding mode by simultaneously varying the voltage pulse amplitude and duty cycle.

The aforementioned parameters should be set differently for different welding processes, depending on the requirements of the operator. Operations required to set these parameters in the current welding process are described in **Section 6.1.**

6. SETTING THE WELDING UNIT

When no button on the front panel of the welding unit is pressed, the digital display of the unit shows the value of the basic parameter of the current welding process:

1. Welding current in the manual arc welding process (MMA)
2. Welding current in the argon shielded tungsten-arc welding process (TIG)
3. Welding voltage in the semiautomatic arc welding process (MIG/MAG)

Multifunction button 5 on the front panel of the welding unit is designed for performing the following functions:

1. When the button is pressed and released fast, the sequential selection of any function in the current welding process is provided.
2. If the button is pressed and held more than 5 s, the sequential selection of any welding process is provided.
3. If the button is pressed and held for more than 12 s, the return of the values of the functions and parameters of the welding unit to the default factory values set for of the current welding process are provided.

Buttons 3 on the front panel are designed for changing the value of the function or basic parameter selected.

6.1. SWITCHING TO THE REQUIRED FUNCTION

When button 5 on the front panel is pressed and held in the pressed state, the digital display shows the designation of the current function. When the button is released, the digital display shows the current value of this function. The value may be increased or decreased by buttons 3. By pressing and releasing button 5 fast, it is possible to sequentially switch to the next function.

WARNING! If button 5 is pressed and held down, the display will blink once approximately after 3.5 s. The blinking means that the button should be released; otherwise, the welding unit will be ready to switch to the next welding process **(see Section 6.2).**

6.2. SWITCHING TO THE REQUIRED WELDING PROCESS

When button 5 is pressed and held for more than 5 s, the digital display will blink. The blinking means that, when the button is released, the welding unit will switch to the next welding process. The switching is provided sequentially and selection of the welding processes is indicated by lamps 4 on the front panel. This switching process may appear to be lengthy, but it should be noted that this process is not often required in operating the welding unit.

WARNING! If button 5 is held for more than 12 s, the display will show readouts 333 … 222 … 111 … 000. In this state, release the button before the end of the readout indication period (000); otherwise, all the values of the functions and parameters of the welding unit will return to the default factory values set for the current welding process **(see Section 6.3).**

6.3. RETURN OF THE VALUES OF THE FUNCTIONS AND PARAMETERS OF THE WELDING UNIT TO THE DEFAULT FACTORY VALUES SET FOR THE CURRENT WELDING PROCESS

There might be conditions when the operator cannot set the welding unit parameters properly. In this case, press button 5 and hold it for more than 12 s. At the 5th second, the welding unit will be ready to switch to the next welding process. Nevertheless, hold the button. After 5 seconds, the display will show readouts 333 … 222 … 111 … 000. When the readout is 000, the values of the functions and parameters of the welding unit will return to the default factory set values. These operations for setting default parameter values should be performed individually for all the welding processes of the welding unit.

7. COMPLETE LIST OF THE WELDING UNIT FUNCTIONS AND PARAMETERS

7.1. MANUAL ARC WELDING PROCESS (MMA)

0) [-1-]	Basic indicated parameter: welding current 90 A (default value) a) 10 … 200 A (positive or negative increment 1 A) for PSI-200P b) 12 … 250 A (positive or negative increment 1 A) for PSI-250P c) 12 … 250 A (positive or negative increment 1A) for PSI-250P-400V
1) [H.St]	Current intensity in the increased-current arc starting mode: 40 % (default value) a) 0 [OFF] … 100 % at low currents (positive or negative increment 1 %)
2) [t.HS]	Period of the increased-current arc starting: 0.3 s (default value) a) 0.1 … 1.0 s (positive or negative increment 0.1 s)
3) [Ar.F]	Voltage in the reduced-voltage welding mode: 40 % (default value) a) 0 [OFF] … 100 % at low currents (positive or negative increment 1 %)
4) [u.AF]	Threshold voltage for the reduced-voltage welding mode: 12 V (default value) a) 9 … 18 V (positive or negative increment 1 V)
5) [BAH]	Volt-ampere characteristic slope: 1.4 V/A (default value) a) 0.2 … 1.8 V/A (positive or negative increment 0.4 V/A)
6) [Sh.A]	Short arc welding mode: OFF (default value) a) ON b) OFF
7) [BSn]	Reduction of voltage: OFF (default value) a) ON b) OFF
8) [Po.P]	Current pulse amplitude: OFF (default value] a) 0 [OFF] … 80 % (positive or negative increment 1 %)
9) Fr.P]	Current pulse frequency: 50 Hz (default value] a) 10 … 500 Hz (positive or negative increment 1 Hz)
10) [dut]	Duty cycle (the ratio of the pulse length to the pulse repetition period): 50 % (default value) a) 20 … 80 % (positive or negative increment 1 %)

7.2. ARGON SHIELDED TUNGSTEN-ARC WELDING PROCESS (TIG)

0) [-2-]	Basic indicated parameter: welding current 100 A (default value) a) 10 … 200 A (positive or negative increment 1 A) for PSI-200P b) 12 … 250 A (positive or negative increment 1 A) for PSI-250P c) 12 … 250 A (positive or negative increment 1 A) for PSI-250P-400V
1) [But]	Function of the button on the welding torch: [LFt] (default value) a) [LFt] - contact arc starting, function TIG-LIFT b) [2t] - contactless arc starting, function TIG-2T c) [4t] - contactless arc starting, function TIG-4T
2) [Pr.A]	Initial current (pilot arc current): 15 A (default value) a) 10 … 40 A (positive or negative increment 1 A) for PSI-200P b) 12 … 40 A (positive or negative increment 1 A) for PSI-250P c) 12 … 40 A (positive or negative increment 1 A) for PSI-250P-400V
3) [t.uP]	Period of current rise: 1.0 s (default value) a) 0.1 … 5.0 s (positive or negative increment 0.1 s)

4) [t.dn]	Period of current reduction: 2.0 s (default value) a) 0.1 … 5.0 s (positive or negative increment 0.1 s)
5) [Po.A]	Crater welding current: 20 A (default value) a) 8 … 60 A (positive or negative increment 1 A) for PSI-200P b) 10 … 60 A (positive or negative increment 1 A) for PSI-250P c) 10 … 60 A (positive or negative increment 1 A) for PSI-250P-400V
6) [Po.P]	Current pulse amplitude: OFF (default value] a) 0 [OFF] … 80 % (positive or negative increment 1 %)
7) [Fr.P]	Current pulse frequency: 5.0 Hz (default value] a) 0.2 … 50 Hz (positive or negative increment 1 Hz)
8) [dut]	Duty cycle (the ratio of the pulse length to the pulse repetition period): 50 % (default value) a) 20 … 80 % (positive or negative increment 1 %)

7.3. SEMIAUTOMATIC ARC WELDING PROCESS (MIG/MAG)

0) [-3-]	Basic indicated parameter: welding voltage 19.0 V (default value) a) 12.0 … 28.0 A (positive or negative increment 0.1 V)
1) [t.dn]	Period of voltage reduction: 1.0 s (default value) a) 0.1 … 5.0 s (positive or negative increment 0.1 s)
2) [Po.P]	Voltage pulse amplitude: OFF (default value] a) 0 [OFF] … 80 % (positive or negative increment 1 %)
3) [Fr.P]	Voltage pulse frequency: 20 Hz (default value] a) 5 … 200 Hz (positive or negative increment 1 Hz)
4) [dut]	Duty cycle (the ratio of the pulse length to the pulse repetition period): 50 % (default value) a) 20 … 80 % (positive or negative increment 1 %)

8. MAINTENANCE

WARNING! Before maintenance, switch off the welding unit and disconnect the power cable from the outlet of the power supply system. Wait for about 5 minutes until static charges in the unit circuits disappear, and then perform the maintenance operations. After completion of works with the welding unit, apply to the unit a plate with a warning text prohibiting switching on the unit.

For ensuring the operability of the welding unit for a long-term service life, it is necessary to perform the following procedures:

- Periodically, at specified time intervals, check that the safety requirements in operation of the welding unit are fulfilled **(see Section 15, "Safety instructions").**
- At half-yearly intervals, purge the welding unit with dry compressed air.
- When working in environment with excessive dust content, manually clean the passages for cooling air.

WARNING! Purging the unit with compressed air at short distance can result in damage of the electronic elements of the unit.

9. OPERATION WITH AN ELECTRIC GENERATOR

The welding unit can operate with power supply from an electric generator if the following conditions are satisfied:

Electrode diameter (mm)	Set welding current in the MMA and TIG welding processes (A)	Electrode wire diameter in the MIG/MAG welding process (mm)	Minimum power of the generator (kVA)
Φ 2	Not more than 80	Not more than 0.6	2.9
Φ 3	Not more than 120	Not more than 0.8	4.5
Φ 4	Not more than 160	Not more than 1.0	6.2
Φ 5	Not more than 200	Not more than 1.0	8.0
Φ 6 for a free-melting electrode	Up to 250	Up to 1.2	11.0

WARNING! The output voltage of the electric generator must in the range of 160 … 260 V.

10. STORAGE

The preserved and packed welding unit can be stored according to State Norm **for 5 years.** The welding unit should be stored in a dry closed room at an ambient temperature not lower than 5ºC. In the room, acid vapors and chemically active substances must not be present.

11. TRANSPORTATION

The packed welding unit can be transported by any means of transport, which ensure the integrity of the unit and compliance of the unit with the shipping rules established for the specified transport means.

12. SPECIFICATION DATA

WARNING! If the welding unit is rated for a special power supply voltage, the specification data of the unit are indicated on the nameplate on the rear panel of the unit. In this case, the electrical outlet of the power supply system and the power cable of the welding unit should be selected with consideration for the actual power supply voltage.

Rated power supply voltage, 50/60 Hz, V	230 V
Power supply voltage range	160 … 260 V
Efficiency coefficient (at the rated current)	92 %
Welding current control range	10 … 200 A for PSI-200P 12 … 250 A for PSI-250P 12 … 250 A for PSI-250P-400V
Welding current at a load factor of 45 %, for 5 minutes	200 A for PSI-200P 250 A for PSI-250P
Welding current at a load factor of 100 %, for 5 minutes	167 A for PSI-200P 208 A for PSI-250P
Maximum consumed power	6.6 … 8.0 kVA for PSI-200P 8.5 … 11.0 kVA for PSI-250P 8.5 … 11.0 kVA for PSI-250P-400V
Normal operating voltage for the manual arc welding process	21 … 28 V
Normal operating voltage for the argon arc welding process	10 … 18 V
Normal operating voltage for the semiautomatic arc welding process	12 … 28 V

13. DELIVERY SET

1. Welding unit with a power cable 3 m in length – 1 pcs;
2. Electrode wire feeding unit with rollers for wire (0.6-0.8 and 1.0-1.2) mm – 1 pcs;
3. **ABICOR BINZEL** torche with a cable 3 m in length – 1 pcs;
4. Welding cable with a grounding clamp, 3 m in length – 1 pcs;
5. Shoulder-carry belt – 1 pcs;
6. Cardboard packaging **„PATON™”** – 1 pcs;
7. Operation manual of ABICOR BINZEL torche – 1 pcs;
8. Operation manual of device – 1 pcs;

14. WARRANTY

The Pilot Plant of Welding Equipment of the E.O Paton Electric Welding Institute guarantees the correct operation of the power supply if the costumers provided service conditions, storage and transportation.

ATTENTION!!! Warranty commitments are cancelled in case of mechanical damage.

Term of the main guarantees for welding inverter series PRO is 5 years. The basic warranty period is calculated from the date of sale to the end customer of the inverter equipment.
During the main warranty period, the seller covenants charge the inverter equipment of **PATON™** to the owner:

- To diagnose and determine the cause of failure,
- To ensure the necessary repairs to units and elements,
- To carry out work on the replacement of defective components and units,
- To test the repaired equipment.

The basic warranty obligations do not include devices:

- Mechanical damage affected the availability of the device (deformation body parts and in consequence of a fall or drop heavy objects on the equipment, loss of pins and connectors)
- Traces of corrosion that caused the fault condition,
- The failed because of the impact on its power and electronic elements abundant moisture,
- The failed due to the accumulation of conductive dust inside (coal dust, metal chips, etc.),
- In case of attempting to repair its nodes and / or replacement of electronic components,

Once on six months, clean internal parts and components with compressed air when removing the protective box in order to avoid exit of the unit system on the equipment. Cleaning should be carried out carefully, keeping the compressor hose at a sufficient distance to avoid damage to the soldering of electronic components and mechanical parts.

Also, the basic warranty does not apply to defective external elements of equipment that exposed to physical contact and the attendant / supplies. Claims on the fallowing items are accepted no later than two weeks from the date of sale:

- Pins on and off,
- Knobs of the welding parameters,
- Cabling connectors and sleeves,
- Connectors management
- The power cable and power plug,
- Carrying handle, shoulder strap, carrying case,
- Electrode holder, earth clamp, burners, bayonet connectors, welding cable, hose.

The Seller reserves the right to refuse to provide warranty repairs, or set as the date for the commencement of the warranty a month and year of the machine (set by serial number):

- In case of loss of the passport holder,
- In the absence of a correct or even any passport fill the seller in the sale of the machine,
- In the absence of a serial number on the machine manufacturer reserves the full right to refuse warranty service.

WARNING! The warranty period is extended for the period of the warranty service machine to the service center.

There are 5 years of Basic Warranty on welding inverters series ***STN*** and ***PRO***, but the prerequisite for the implementation of a service through the required period of time (12 months), in an authorized service center. Initial maintenance should be held after 24 months from the date of purchase, each successive every 12 months.

15. INFORMATION CONCERNING DISPOSAL OF EQUIPMENT

(applies to households)

The symbol shown on the product indicates that the appliance can not be disposed of in the same way as household waste. The device must be returned to the point of disposal of electrical equipment where it will be accepted free of charge. Information on such collection points for used equipment can be found on eg websites.
Proper disposal helps preserve valuable natural resources and avoid environmental contamination. Failure to comply with the above recommendations may result in the imposition of fines in accordance with applicable regulations.

If you would like to return the unit for disposal, please contact your nearest point of sale or contact the importer of the equipment for further information.

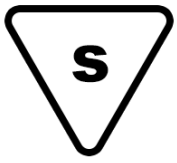
IMPORTER / AUTHORIZED DISTRIBUTOR EU
MasterWeld Sp. z o.o.
25, Tadeusza Boya – Żeleńskiego Street,
Rzeszów City, Poland zip-code 35105
Tel. +48 (17) 779 00 67
e-mail: biuro@paton.com.pl
www.paton.com.pl

16. SAFETY INSTRUCTIONS

GENERAL INFORMATION

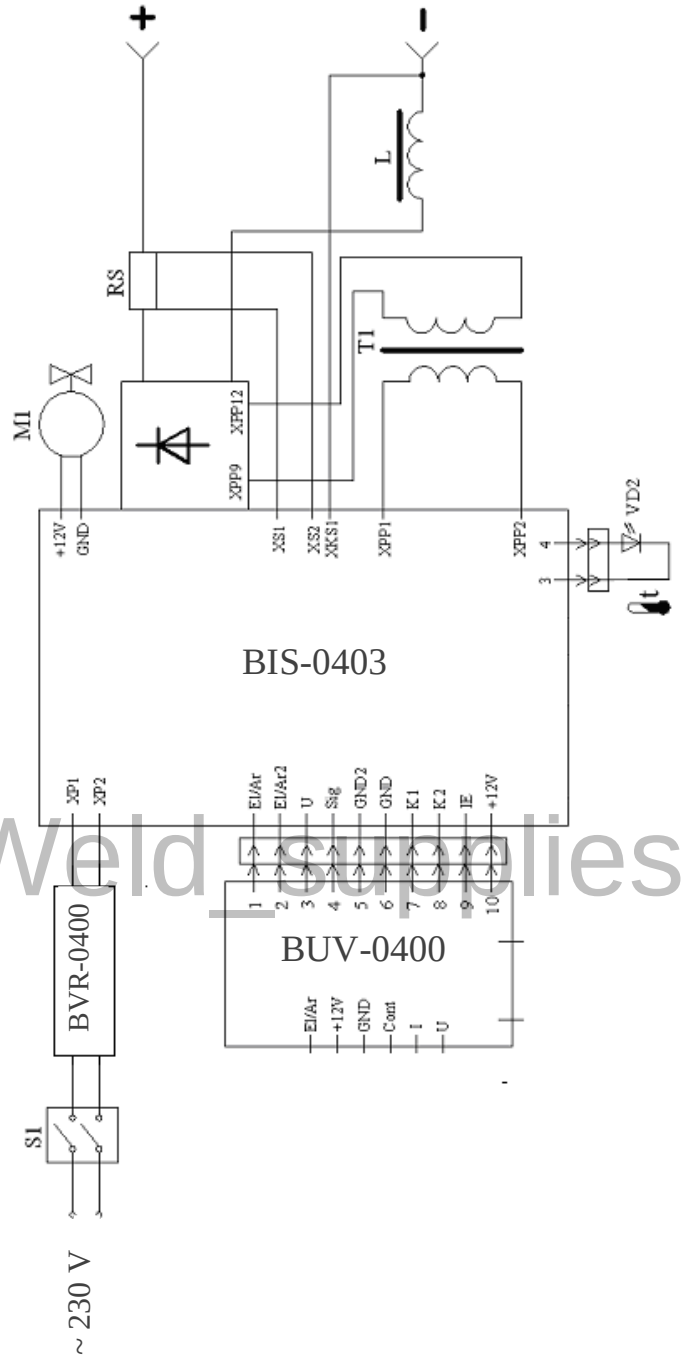
This device may only be used for the purposes for which it was created. This appliance is intended for use by persons with the requisite qualifications. It is the responsibility of the qualified personnel to install, service and repair. Please read this manual carefully before installing and using this product. Failure to follow the instructions in this manual may result in serious personal injury, death and damage to the unit itself. Incorrect installation, maintenance and operation resulting in damage to the device - the manufacturer is not liable.

INSTRUCTION	Before using this product, please read this manual and use the instructions in this manual. This instruction manual is a basic piece of equipment.
	***USER RESPONSIBILITIES:*** The user agrees to allow only persons who: have been acquainted with the basic safety rules, have been trained in the use of welding equipment and have appropriate qualifications. They are familiar with the chapter "Safety Regulations" and the precautionary guidelines in this manual.
THREATS	
	***ELECTRIC SHOCK CAN KILL:*** Welding devices produce high voltage. While the machine is connected to the power supply, it is not allowed to touch the welding handle and the workpiece. All of these elements form a welding current circuit and may cause electric shock, so avoid touching them with bare hands and wet or damaged protective clothing. Protective clothing should not restrain movements. If possible, it should not be made of synthetic materials. **Electrocution can be fatal !!!**
	***ARC RAYS CAN BURN****:* It is not allowed to directly observe the welding arc with uncovered eyes. Arc and splinters may cause skin burns or flames, so always wear a protective mask fitted with a darkened filter (glasses should be equipped with glass filter grade DIN 9 10) Any unauthorized persons near your site should protect your eyes with special protective goggles or with non-flammable, radiation-absorbing screens.
	***VAPOUR AND GASES MAY BE DANGEROUS:*** The resulting smoke and harmful gases should be removed from the work area by means of specialized equipment, do not cover the ventilation openings. Welding should be carried out in well ventilated areas and welding vapors are harmful to health - especially when welding materials such as lead, mercury, cadmium, zinc, beryllium, galvanized or stainless steel. Ensure sufficient fresh air flow in the room. Do not allow solvent vapors to enter the welding arc area.
	***ELECTROMAGNETIC POLE MAY BE DANGEROUS:*** By inducing a high voltage current, the electromagnetic field flowing through the welding wires may have a negative effect on the performance of electrical devices such as the cardio-stimulator. Persons wearing such equipment should consult a physician before entering the area where welding work is performed. Welding hoses should be arranged in parallel, as close as possible to each other.
	***ELECTRICAL SPARK MAY CAUSE FIRE OR EXPLOSIVES:*** Flammable items should be removed from the workplace. Do not perform welding work on containers that contain gases, fuels, oil products or other flammable materials. There is a risk of explosion of residue of these products. When performing welding work in potentially explosive or fire hazards, special rules must be observed that comply with national and international standards. Firefighting equipment such as: (powder or snow fire extinguishers, fire blankets) should be located near the workstation in a visible, readily accessible place.
	BOTTLE CAN EXPLODE: Use only approved bottles and properly

	functioning regulators. The cylinder should be transported and positioned vertically. Protect the cylinder from heat, overturning and mechanical damage.
	***WELDED MATERIALS MAY BURN:*** In no case should you touch the welded parts with bare hands. Always wear protective gloves when operating the machine. The arc and splinters that develop during the burn can cause skin burns. Wear protective gloves and pliers when touching or moving the welded item.
	***ELECTRIC POWER SOURCES:*** It is forbidden to work with damaged welding wires or on wet substrates. Welding cables should be strong, undamaged and insulated. Weakened connections and damaged cable must be replaced immediately. Do not carry the device by pulling it by the power cord or wires. Do not perform any maintenance work on the unit. **Removing the outside cover of the device while it is connected to the network and using the device with the lid removed is forbidden.**
	***NOISE ASSOCIATED WITH WELDING CAN BE HARMFUL:*** The welding arc formed during welding can emit sounds higher than 85dB for - 8 hours of working time. Welders operating the equipment are obliged to wear equivalent hearing protectors during work in accordance with the Regulation of the Minister of Labor and Social Policy of 6 June 2014r. - Dz. U. 2014 pos. 817. Pursuant to the Ordinance of the Minister of Health on Social Welfare dated 09.07.1996 OJ No. 68 pos. 194 - The employer is required to carry out research and measurement of factors harmful to health.
	***CONFORMITY DECISION:*** This device accomplish the recommendation of the European CE Committee.
	***SAFETY MARK:*** This device is suitable for mains power, for welding work in an environment of higher standard of electric shock. It is recommended that the power line be provided with a separate protection against the shock absorber.

17. ELECTRICAL SCHEMATIC DIAGRAM

Basic electrical diagram
Source PATON PSI-200P or 250P DC MIG/MAG MMA/TIG



18. ACCEPTANCE CERTIFICATE

Digital Inverter rectifiers „***PATON™ PSI-_____P***”

The serial number: _____***PRO*** complies with the harmonized standards and is fit for use.

Date of sale "___" _____ 20___ year

Stamp here _____

(signature of the seller)

==========

Address of the Central PATON™ Service Center

Invertech – Piotr Błaszkowski
9, Ludwika Zamenhofa Street
Sanok City, Poland zip-code 38500

Head of Service Center
Piotr Błaszkowski
Phone: +48 889 226 032
e-mail: serwis@paton.com.pl

ATTENTION!!! DO NOT SEND the welding cables for repair, as these equipment items are not required for repair.

ATTENTION!!! Delivery of the equipment to the service center **"PATON"** is performed at the manufacturer's expense only during the 1st of the year from the date of purchase! Over 1 year - at the buyer's expense.

Date of reception of the welding unit for repair **«_____» _____** 20 **___** year.

_____
(signature)

Faults detected:

_____

_____

_____

Faulty-condition cause:

_____

_____

_____

_____

Date of reception of the welding unit for repair «_____» _____ 20 ___ year.

_____
(signature)

Faults detected:

_____

_____

_____

Faulty-condition cause:

_____

_____

_____

_____

Tel. Technical support: +48 889 226 032
Address of the service center: 38500, Poland, Sanok, Zamenhofa 9 Street
==========

Date of reception of the welding unit for repair **«_____» _____** 20 **___** year.

_____
(signature)

Faults detected:

_____

_____

_____

Faulty-condition cause:

_____

_____

_____

_____

Tel. Technical support: +48 889 226 032
Address of the service center: 38500, Poland, Sanok, Zamenhofa 9 Street
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