Renegade ET 350iPA

Instruction manual

0448 690 001 US 20250324

Valid for: DC440YY-XXXXXX

1 SAFETY

1.1 Meaning of symbols

As used throughout this manual: Means Attention! Be Alert!

DANGER!
Means immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.

WARNING!
Means potential hazards which could result in personal injury or loss of life.

CAUTION!
Means hazards which could result in minor personal injury.

WARNING!
Before use, read and understand the instruction manual and follow all labels, employer´s safety practices and Safety Data Sheets (SDSs).

1.2 Safety Precautions

WARNING!
These Safety Precautions are for your protection. They summarize precautionary information from the references listed in the Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe Safety Precautions can result in injury or death.

PROTECT YOURSELF AND OTHERS

Some welding, cutting and gouging processes are noisy and require ear protection. The arc, like the sun, emits ultraviolet (UV) and other radiation and can injure skin and eyes. Hot metal can cause burns. Training in the proper use of the processes and equipment is essential to prevent accidents. Therefore:

1. Wear a welding helmet fitted with a proper shade of filter to protect your face and eyes when welding or watching.
2. Always wear safety glasses with side shields in any work area, even if welding helmets, face shields and goggles are also required.
3. Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck and ears from sparks and rays of the arc when operating or observing operations. Warn bystanders not to watch the arc and not to expose themselves to the rays of the electric-arc or hot metal.
4. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped shoes and a welding helmet or cap for protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.
5. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned and open pockets eliminated from the front of clothing.
6. Protect other personnel from arc rays and hot sparks with a suitable non-flammable partition or curtains.
7. Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.

FIRES AND EXPLOSIONS

Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

1. Protect yourself and others from flying sparks and hot metal.
2. Remove all combustible materials well away from the work area or cover the materials with a protective non-flammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings paper, etc.
3. Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal.
4. Do not weld, cut or perform other hot work until the work piece has been completely cleaned so that there are no substances on the work piece which might produce flammable or toxic vapors. Do not do hot work on closed containers, they may explode.
5. Have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher. Be sure you are trained in its use.
6. Do not use equipment beyond its ratings. For example, an overloaded welding cable can overheat and create a fire hazard.
7. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.

ELECTRICAL SHOCK

Contact with live electrical parts and ground can cause severe injury or death. DO NOT use AC welding current in damp areas, if movement is confined, or if there is danger of falling. Therefore:

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.
2. Connect the workpiece to a good electrical ground.
3. Connect the work cable to the workpiece. A poor or missing connection can expose you or others to a fatal shock.
4. Use well-maintained equipment. Replace worn or damaged cables.
5. Keep everything dry, including clothing, work area, cables, torch/electrode holder and power source.
6. Make sure that all parts of your body are insulated from both the work piece and from the ground.
7. Do not stand directly on metal or the earth while working in tight quarters or a damp area; stand on dry boards or an insulating platform and wear rubber-soled shoes.
8. Put on dry, hole-free gloves before turning on the power.
9. Turn off the power before removing your gloves.
10. Refer to ANSI/ASC Standard Z49.1 for specific grounding recommendations. Do not mistake the work lead for a ground cable.

ELECTRIC AND MAGNETIC FIELDS

May be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Welders with pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.
2. Exposure to EMF may have other health effects which are unknown.

3. Welders should use the following procedures to minimize exposure to EMF:
   a) Route the electrode and work cables together. Secure them with tape when possible.
   b) Never coil the torch or work cable around your body.
   c) Do not place your body between the torch and work cables. Route cables on the same side of your body.
   d) Connect the work cable to the workpiece as close as possible to the area being welded.
   e) Keep welding power source and cables as far away from your body as possible.

FUMES AND GASES

Fumes and gases can cause discomfort or harm, particularly in confined spaces. Shielding gases can cause asphyxiation. Therefore:

1. Keep your head out of the fumes. Do not breathe the fumes and gases.
2. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
3. Do not operate near degreasing and spraying operations. The heat or arc can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.
4. If you develop momentary eye, nose or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.
5. Refer to ANSI/ASC Standard Z49.1 for specific ventilation recommendations.

CYLINDER HANDLING

Cylinders, if mishandled, can rupture and violently release gas. A sudden rupture of cylinder valve or relief device can injure or kill. Therefore:

1. Locate cylinders away from heat, sparks and flames. Never strike an arc on a cylinder.
2. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adapters. Maintain hoses and fittings in good condition. Follow manufacturer's operating instructions for mounting regulator to a compressed gas cylinder.
3. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, wall, post or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.
4. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks.

MOVING PARTS

Moving parts, such as fans, rotors and belts can cause injury. Therefore:

1. Keep all doors, panels, guards and covers closed and securely in place.
2. Have only qualified people remove covers for maintenance and troubleshooting as necessary
3. Keep hands, hair, loose clothing and tools away from moving parts.
4. Reinstall panels or covers and close doors when service is finished and before starting the unit.

WARNING!
FALLING EQUIPMENT CAN INJURE

- Only use lifting eye to lift unit. Do NOT use running gear, gas cylinders or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.
- Keep cables and cords away from moving vehicles when working from an aerial location.

WARNING!
EQUIPMENT MAINTENANCE

Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.
3. Maintain cables, earthing wire, connections, power cord and power supply in safe working order. Do not operate any equipment in faulty condition.
4. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
5. Keep all safety devices and cabinet covers in position and in good repair.
6. Use equipment only for its intended purpose. Do not modify it in any manner.

CAUTION!
ADDITIONAL SAFETY INFORMATION

For more information on safe practices for electric arc welding and cutting equipment, ask your supplier for a copy of “Precautions and Safe Practices for Arc Welding, Cutting and Gouging”, Form 52-529.

The following publications are recommended:

- ANSI/ASC Z49.1 - “Safety in Welding and Cutting”
- AWS C5.5 - “Recommended Practices for Gas Tungsten Arc Welding”
- AWS C5.6 - “Recommended Practices for Gas Metal Arc welding”
- AWS SP - “Safe practices” - Reprint, Welding Handbook
- ANSI/AWS F4.1 - “Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances”
- OSHA 29 CFR 1910 - "Safety and health standards"
- CSA W117.2 - "Code for safety in welding and cutting"
- NFPA Standard 51B, “Fire Prevention During Welding, Cutting, and Other Hot Work"
- CGA Standard P-1, “Precautions for Safe Handling of Compressed Gases in Cylinders”
- ANSI Z87.1, "Occupational and Educational Personal Eye and Face Protection Devices"

1.3 User responsibility

Users of ESAB equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

All work must be carried out by trained personnel well-acquainted with the operation of the equipment. Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

1. Anyone who uses the equipment must be familiar with:
   - its operation
   - location of emergency stops
   - its function
   - relevant safety precautions
   - welding and cutting or other applicable operation of the equipment
2. The operator must ensure that:
   - no unauthorized person is stationed within the working area of the equipment when it is started up
   - no-one is unprotected when the arc is struck or work is started with the equipment
3. The workplace must:
   - be suitable for the purpose
   - be free from drafts
4. Personal safety equipment:
   - Always wear recommended personal safety equipment, such as safety glasses, flame-proof clothing, safety gloves
   - Do not wear loose-fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns
5. General precautions:
   - Make sure the return cable is connected securely
   - Work on high voltage equipment **may only be carried out by a qualified electrician**
   - Appropriate fire extinguishing equipment must be clearly marked and close at hand
   - Lubrication and maintenance must **not** be carried out on the equipment during operation

WARNING!
Arc welding and cutting can be injurious to yourself and others. Take precautions when welding and cutting.

ELECTRIC SHOCK - Can kill

- Install and ground the unit in accordance with instruction manual.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from work and ground.
- Ensure your working position is safe

ELECTRIC AND MAGNETIC FIELDS - Can be dangerous to health

- Welders with pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.
- Exposure to EMF may have other health effects which are unknown.
- Welders should use the following procedures to minimize exposure to EMF:
  - Route the electrode and work cables together on the same side of your body. Secure them with tape when possible. Do not place your body between the torch and work cables. Never coil the torch or work cable around your body. Keep welding power source and cables as far away from your body as possible.
  - Connect the work cable to the workpiece as close as possible to the area being welded.

FUMES AND GASES - Can be dangerous to health

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to take fumes and gases away from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin

- Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

NOISE - Excessive noise can damage hearing

Protect your ears. Use earmuffs or other hearing protection.

MOVING PARTS - Can cause injuries

- Keep all doors, panels, guards, and covers closed and securely in place.
- Have only qualified people remove covers for maintenance and troubleshooting as necessary.

- Keep hands, hair, loose clothing and tools away from moving parts.
- Reinstall panels or covers and close doors when service is finished and before starting the unit.

FIRE HAZARD

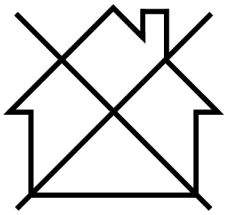
- Sparks (spatter) can cause fire. Make sure that there are no inflammable materials nearby.
- Do not use on closed containers.

HOT SURFACE - Parts can burn

- Do not touch parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or insulated welding gloves to prevent burns.

CAUTION!
This product is solely intended for arc welding.

CAUTION!
Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility of class A equipment in those locations, due to conducted as well as radiated disturbances.

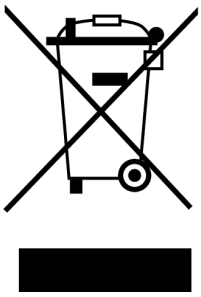


NOTE!
Dispose of electronic equipment at the recycling facility!

In observance of European Directive 2012/19/EC on Waste Electrical and Electronic Equipment and its implementation in accordance with national law, electrical and/or electronic equipment that has reached the end of its life must be disposed of at a recycling facility.

As the person responsible for the equipment, it is your responsibility to obtain information on approved collection stations.

For further information contact the nearest ESAB dealer.



1.4 California proposition 65 warning

WARNING!
Welding or cutting equipment produces fumes or gases which contain chemicals known in the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Section 25249.5 et seq.)

WARNING!
This product can expose you to chemicals including lead, which are known to the state of California to cause cancer and birth defects or other reproductive harm. Wash hands after use.

For more information, go to **www.P65Warnings.ca.gov**.

ESAB has an assortment of welding accessories and personal protection equipment for purchase. For ordering information contact your local ESAB dealer or visit us on our website.

2 INTRODUCTION

Renegade ET 350iPA is an inverter-based power source intended for MMA / SMAW / Stick, TIG / GTAW, LiftArc™, TIG Pulse and HF TIG welding.

ESAB accessories for the product can be found in the "ACCESSORIES" chapter of this manual.

2.1 Equipment

Renegade ET 350iPA includes:

- Power source
- Work clamp lead set
- Gas hose
- Instruction manual
- Quick Start Guide

3 TECHNICAL DATA

Renegade ET 350iPA	
Outlet voltage	400 V ± 15%, 3 Φ 50/60 Hz
Primary current	
I_{max}	22 A
No-load power demand when in energy-saving mode	40 W
Setting range	
SMAW	5–300 A
GTAW	5–350 A
Permissible load at SMAW	
60% duty cycle	300 A / 32 V
100% duty cycle	192 A / 27.7 V
Permissible load at GTAW	
60% duty cycle	350 A / 24 V
100% duty cycle	271 A / 20.8 V
Apparent power I_2 at maximum current	13.9 kVA
Active power I_2 at maximum current	10.4 kW
Power factor at maximum current	
SMAW	0.75
GTAW	0.83
Efficiency at maximum current	
SMAW	91%
Open-circuit voltage U_0 max	
VRD deactivated	62 V
VRD activated	<15 V
Operating temperature	+14 to 104°F (-10 to +40°C)
Transportation temperature	-4 to +161°F (-20 to +55°C)
Constant sound pressure when idling	<70 db(A)
Dimensions l × w × h	18.1 × 7.9 × 12.6 in. (460 × 200 × 320 mm)
Weight	35.9 lbs (16.3 kg)
Insulation class	F
Enclosure class	IP23S
Application class	S

Duty cycle
The duty cycle refers to the time as a percentage of a ten-minute period that you can weld or cut at a certain load without overloading. The duty cycle is valid for 104 °F (40 °C), or below.

Enclosure class
The **IP** code indicates the enclosure class, i.e. the degree of protection against penetration by solid objects or water.

Equipment marked **IP23S** is intended for indoor and outdoor use; however, it should not be operated in precipitation.

Application class
The symbol S indicates that the power source is designed for use in areas with increased electrical hazard.

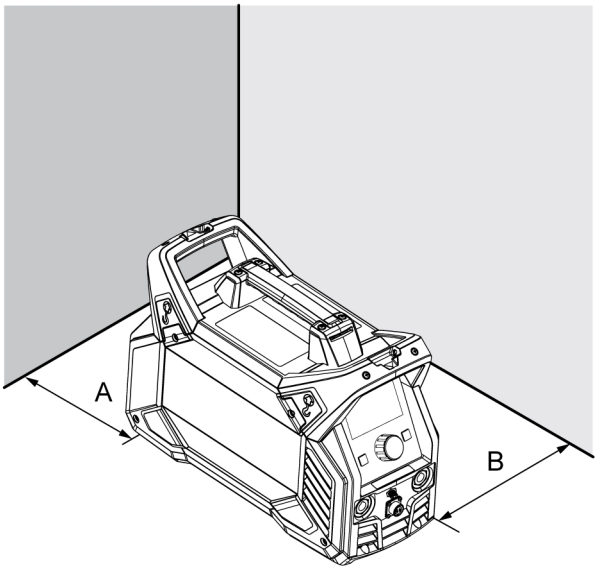
4 INSTALLATION

The installation must be carried out by a professional.

CAUTION!
This product is intended for industrial use. In a domestic environment this product may cause radio interference. It is the user's responsibility to take adequate precautions.

4.1 Location

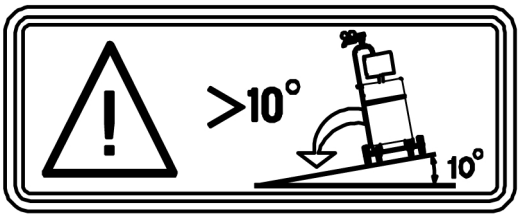
Position the power source so that cooling air inlets and outlets are not obstructed.



A. Minimum 200 mm (8 in.)

B. Minimum 200 mm (8 in.)

WARNING!
Secure the equipment - particularly if the ground is uneven or sloping.



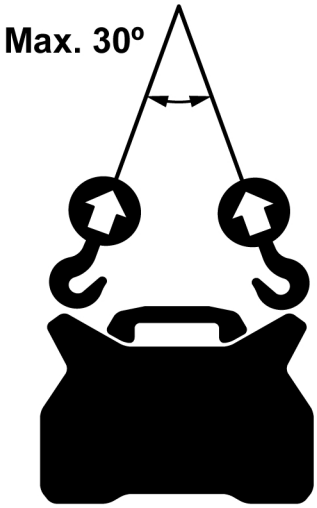
4.2 Lifting instructions

These units are equipped with a handle for carrying purposes.

WARNING!
Electric shock can kill. Do not touch live electrical parts. Disconnect the input power conductors from the de-energized supply line before moving the welding power source.

WARNING!
Falling equipment can cause serious personal injury and equipment damage.

Lift the unit with the handle on top of the case.

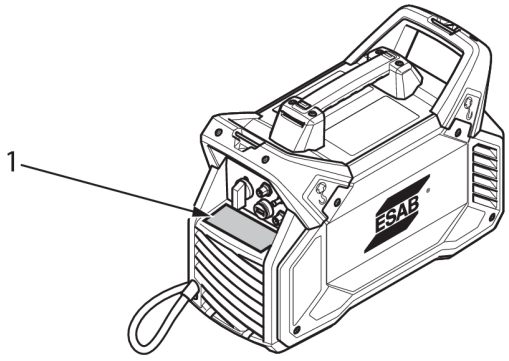


4.3 Mains supply

NOTE!
Mains supply requirements

This equipment complies with IEC 61000-3-12 provided that the short-circuit power is greater than or equal to S_{scmin} at the interface point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power greater than or equal to S_{scmin}.

1. Rating plate with supply connection data.



Recommended fuse sizes and minimum cable area for the Renegade ET 350iPA	
Supply voltage	400 V AC
Mains cable area	0.006 in.^{2}
Maximal current rating I_{max} MMA/Stick (SMAW)	22 A
I_{1eff} MMA/Stick (SMAW)	17 A
Fuse anti-surge type D MCB	20 A
Maximum recommended extension cord length	328 ft (100 m)
Minimum recommended extension cord size	4×0.006 in^2

Supply from power generators
The power source can be supplied from different types of generators. However, some generators may not provide sufficient power for the welding power source to operate correctly. Generators with Automatic Voltage Regulation (AVR) or with equivalent or better type of regulation, with rated power of 20 kW are recommended.

WARNING!
If used under 340 VAC input supply, the supply plug rating must be higher than 25 A.

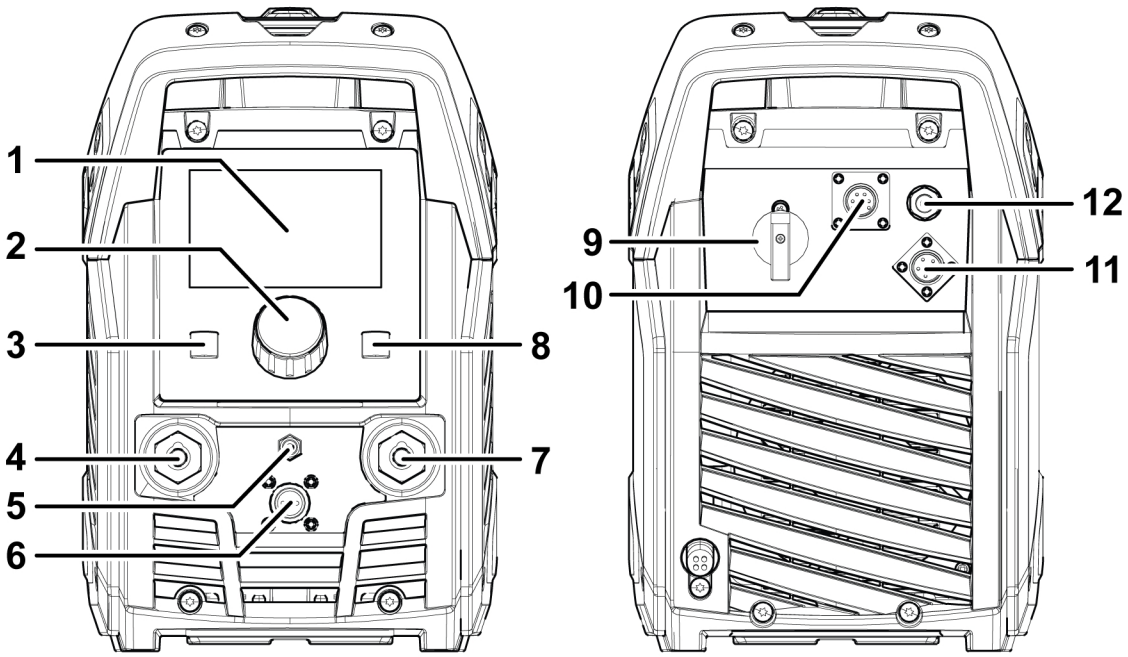
5 OPERATION

General safety regulations for handling the equipment can be found in the "SAFETY" chapter of this manual. Read it through before you start using the equipment!

NOTE!
When moving the equipment use intended handle. Never pull the cables.

WARNING!
Electric shock! Do not touch the workpiece or the welding head during operation!

5.1 Connections and controls



1. Display, 4.33 in.
2. Main knob for menu navigation or value adjustments
3. Back button
4. Positive output (+), OKC 50 male
5. Gas outlet, R 1/8"
6. Torch trigger, 2-pin connector
7. Negative output (-), OKC 50 female
8. Menu button
9. Power switch
10. Remote/torch control connection, 8-pin
11. Cooler connection
12. Shield gas inlet, quick connector type

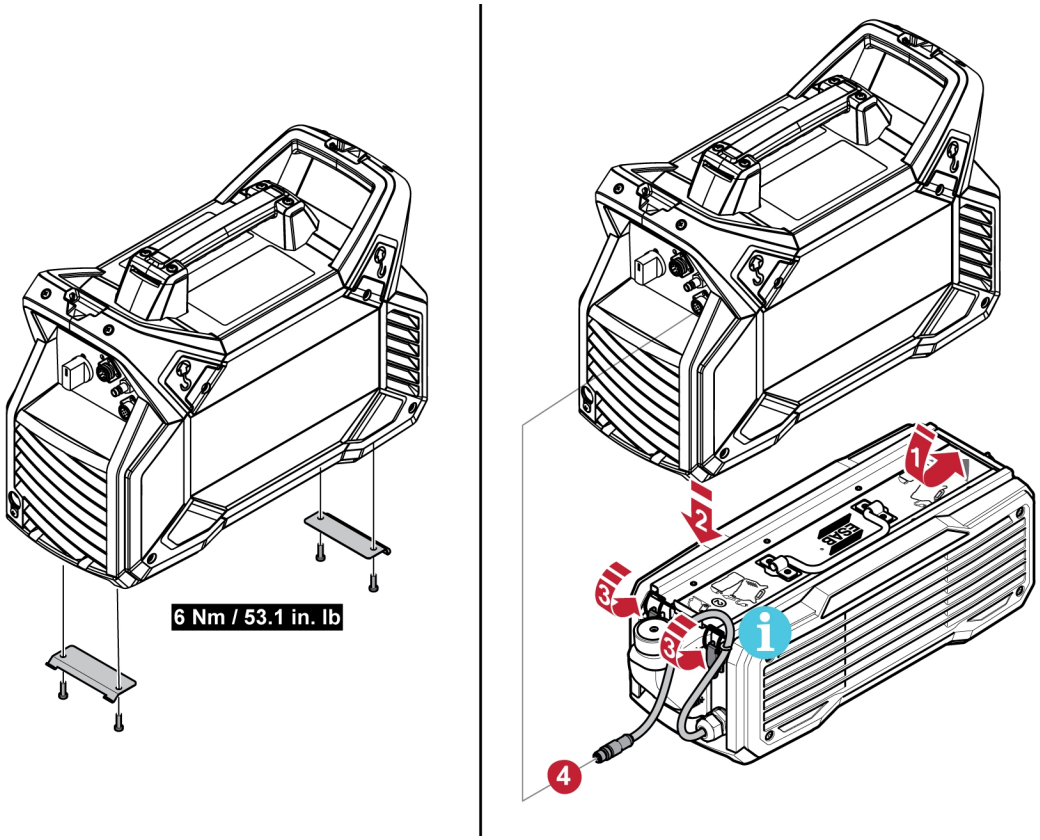
5.2 Connecting welding and return cables

The power source has two outputs, a positive welding terminal (+) and a negative welding terminal (-), for connecting welding and return cables. The output to which the welding cable is connected depends on the welding method or type of electrode used.

Connect the return cable to the other output on the power source. Secure the return cable's contact clamp to the workpiece, and make sure that there is a good contact between the workpiece and the output for the return cable on the power source.

- For GTAW welding, the negative welding terminal (-) is used for the welding torch and the positive welding terminal (+) is used for the return cable.
- For SMAW welding, the welding cable can be connected to the positive welding terminal (+) or negative welding terminal (-), depending on the type of electrode used. The connection polarity is stated on the electrode packaging.

5.3 Connect to cooler EC 1001



NOTE!
Take care so that the interface cable does not get squeezed between the power source and the cooling unit!

NOTE!
Power supply of the cooling unit is done from the welding power source via the connection cable (for more information, refer to the cooling unit instruction manual).

5.4 Fan control

The ET 350iPA is fitted with a fan as an additional feature. When cooling fan is not in use, the fan will automatically turns off.

This has two advantages:

1. To minimize power consumption,
2. To minimize the amount of pollutants absorbed into the power source, such as dust.

NOTE!
When cooling requires, the fan will operate, otherwise it will automatically turn off.

5.5 Thermal protection

The power source includes thermal protection against overheating. When overheating occurs the welding is stopped an error message Error 206 shows in the display. The protection is automatically reset once the temperature has decreased to a safe level.

5.6 Control panel

General safety regulations for handling the equipment can be found in the "Safety precautions" section in the "SAFETY" chapter of this manual.

General information about operation can be found in the "OPERATION" chapter of this manual.

Read and follow your employer's safety practices before installing, operating, or servicing this equipment

NOTE!
After power-ON has completed the main menu appears on the control panel.

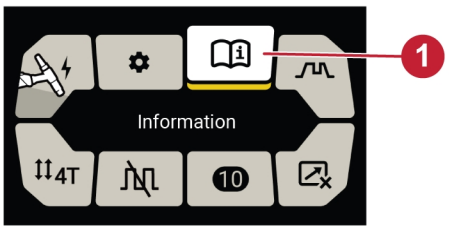
5.6.1 How to navigate

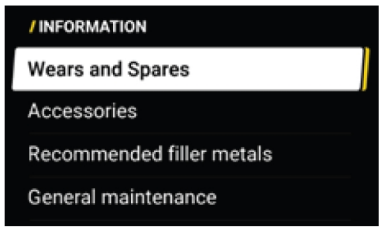
1. Left button switch (Back button)
   a) Press Back button to return to previous screen
   b) Press and hold for 3s to delete jobs (on Jobs screen)
2. Menu navigation: turn and push to select or change values
3. Right button switch (Menu button)

   Press Menu button to return directly to the menu screen or navigate to the home screen

5.7 Information screen

In Information menu user can find information about wears and spares, accessories, recommended filler metals, general maintenance and user manual QR code.

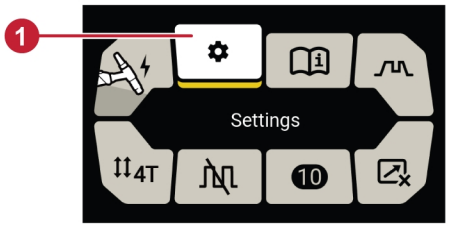




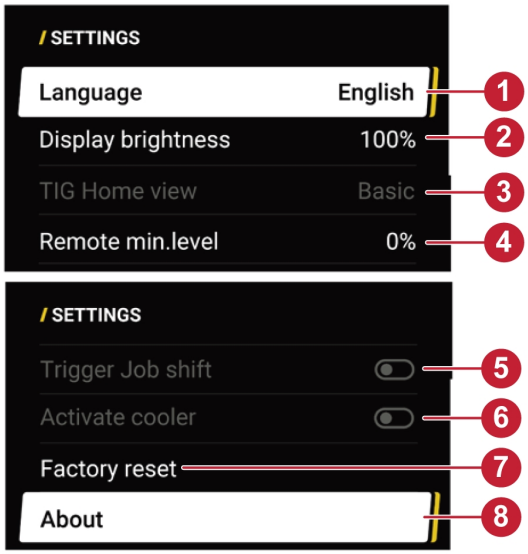
1. Information

5.8 Settings screen

Press Menu button to enter Menu screen. Turn main knob to Settings icon and press main knob to enter settings menu screen.



1. Settings screen



1. Language settings
2. Brightness settings
3. Basic/Advanced (Only TIG)

   This item can be used to select basic view or advanced view of TIG welding sequencer in Home screen. Enter selection screen by turning main knob and pressing when TIG Home view is highlighted. Navigate between Basic and Advanced options and confirm selection by pressing main knob. Display will return to menu screen.
4. Remote min. settings (the percentage of setting Amps)

   This is used to set the minimum current for the foot pedal. It is set in % of the set current in the range from 0–99% in steps of 1%.

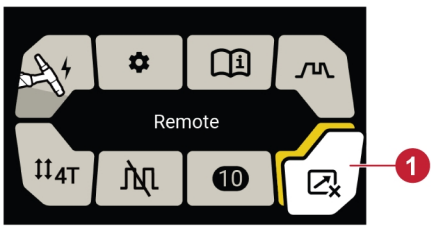
   For example: If the current is set to 100 A and the remote min current function is set to 20, the remote min current will be 20 A. If the current is set to 80 A and the remote min current function is set to 50, the remote min current will be 40 A.

   Enter adjustment screen by pressing main knob when Remote min. level is highlighted and turn the main knob to adjustment percentage value as displayed. Confirm settings by pressing main knob and display will return to menu screen.
5. Trigger job shift ON/OFF (Only TIG)

   Trigger job setting is used to recall stored jobs when machine is on, but arc is not ignited. This function permits changing between different welding data memories by pressing the trigger of the welding torch. User can select one of the first three jobs positions and to recall, trigger needs to be pressed number of times equal to job location (example to recall job #2 quick press trigger twice).

   User can turn ON or OFF trigger job shift function by pressing main knob when this item is highlighted.
6. Cooler ON/OFF (Only TIG)
7. Reset setting
8. About (software version)

5.9 Remote screen

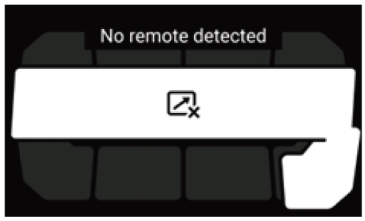


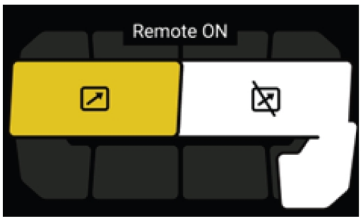
1. Remote screen

Connect the remote control on the rear side of the power source and activate the remote control on the Menu screen. When the remote control is activated the control panel is locked for interaction but displays welding data.

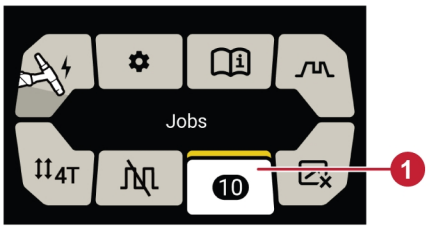
Should a remote device be connected the maximum output current of the power source will be determined by the front panel control knob, irrespective of the remote control device setting. See *"Foot pedal functions explanation"*, page 33.

When no remote device is connected to the power source, the display shows "No remote detected." When a remote device (see options in Accessories screen under Information menu) is connected, turn it ON or OFF by turning main knob. Confirm the selection by pressing main knob and the display returns to the menu screen.



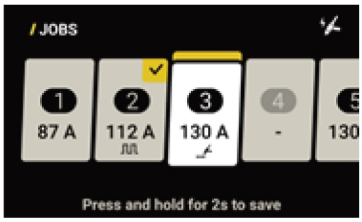


5.10 Jobs screen



1. Jobs screen

Renegade ET 350iPA power source enables the user to store 10 jobs for each welding process. Critical welding data can be previewed in the Jobs menu for easier selection.



To save current welding data, enter Jobs screen to find an available job position or a job position to be replaced, press main knob and hold for 2 seconds.

To recall a job, enter Jobs screen under corresponding welding process menu screen, scroll through Jobs list by rotating main knob, and confirm selection by pressing main knob.

To remove a job, rotate main knob to scroll to the job position, press and hold Back Button until the screen displays “Clear this Job position”, confirm by pressing main knob.

5.11 Welding screen

1. Momentary current value during welding, or average current of last weld after welding.
2. Momentary voltage value during welding, or average voltage of last weld after welding.
3. Arc-on time of the last weld will be displayed after welding.

Parameters of last weld will be displayed for 10 seconds after welding. When the 10 seconds are ended and there is no interaction with the user interface, display returns to previous view before welding.

5.12 SMAW welding

MMA welding may also be referred to as welding with covered electrodes. The arc melts the electrode as well as a local part of the workpiece. The coverage, when melting, forms a protective slag and creates a shielding gas to protect the weld pool from atmospheric contamination.

For SMAW welding the power source shall be supplemented with:

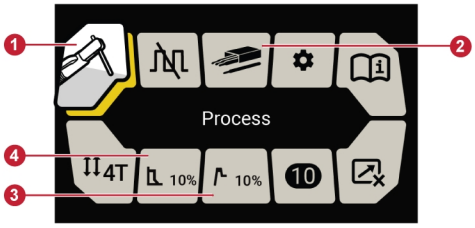
- Welding cable with electrode holder
- Return cable with clamp

5.12.1 MMA/Stick Home screen

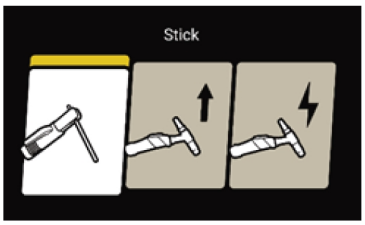
1. VRD: The VRD function ensures that the open-circuit voltage does not exceed 35 V when welding is not being carried out. When VRD is ON “VRD” is displayed in status bar of home screen. Factory default is VRD OFF (except for Australia). Contact an authorized ESAB service technician to activate this function.

2. Preset welding current: rotate main knob clockwise to increase preset welding current or anti-clockwise to decrease preset welding current.
3. Bottom bar of home screen displays status of welding process, arc force level, hot start level, job selection and remote connection. To make any change or adjustment, press the menu button to enter the menu screen and navigate by turning the main knob. See detailed introduction of each function in *"MMA/Stick Menu screen"*, page 22.

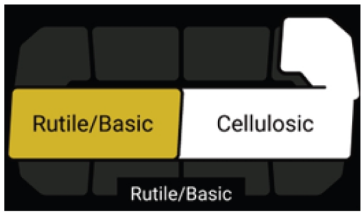
5.12.2 MMA/Stick Menu screen



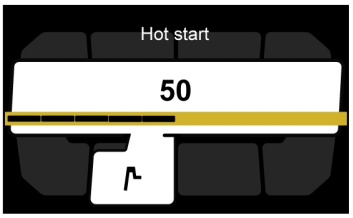
1. Process selection icon: press main knob to enter process selection screen and select Stick (MMA) function by press main knob again.



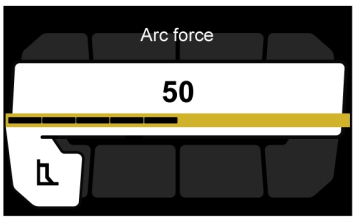
2. Electrode type: select between rutile/basic electrode and cellulosic electrode by turning main knob and confirm selection by pressing main knob.



3. Hot start: The hot start function temporarily increases the current in the beginning of the weld, thus reducing the risk of lack of fusion in the starting point. Turn main knob to adjust hot start level on a scale of 0 to 100 in hot start screen. Confirm the adjustment by pressing the main knob and the adjusted hot start level will be displayed in the menu screen.



4. Arc force: The arc force function determines how the current changes in response to variations in arc length during welding. Use a low value of arc force to get a calm arc with little spatter and use a high value to get a hot and digging arc. Turn main knob to adjust arc force level on a scale of 0 to 100 in arc force screen. Confirm the adjustment by pressing the main knob and the adjusted arc force level will be displayed in the menu screen.



5. Pulse Setting: In order to set a pulsed current, four parameters are required: pulse current, background current, pulse balance and pulse frequency.

Pulse current

The higher of the two current values when using a pulsed current. Setting range is 10 to 210 A.

Pulse background current

The lower of the two current values when using a pulsed current. Setting range is between 10 to 210 A. Factory default is 80 A.

Pulse balance

Pulse balance is the ratio between pulse current and background current in a pulse cycle. In order to control the energy of the arc and the size of the weld pool, pulse balance is adjustable by setting the percentage of the pulse current in a pulse cycle. Setting range is 10-90%, and increment value of each rotation of main knob is 5%. Factory default is 50%.

For example: If the pulse balance is set to 50%, the time of the pulse current and the background current will be distributed equally in the pulse cycle. If the pulse balance is set to 90%, the time of the pulse current will be 90% of the pulse cycle and the background current will only be 10%.

Pulse frequency

The amount of pulse cycles in a time period. The higher the frequency, the more pulse cycles per time period. When the pulse frequency is set low, the weld pool will have time to partially solidify between each pulse. If the frequency is set high, a more focused arc can be obtained.

Setting range is 0.01-999 Hz. Increment value at each rotation of main knob changes as listed below. Factory default setting is 100 Hz.

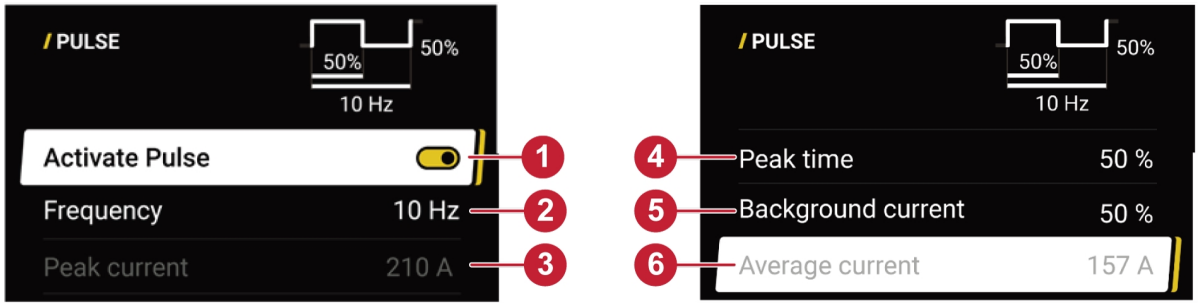
0.01-0.99: 0.01

1.0-9.9: 0.1

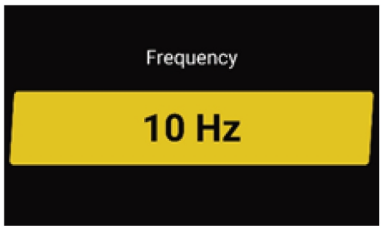
10-100: 1

100-300: 10

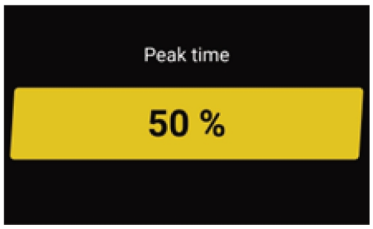
300-999: 100



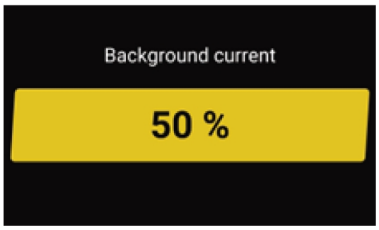
1. Pulse ON/OFF (push main knob to switch between ON and OFF)
2. Frequency settings (push main knob and rotate to adjust)



3. Peak current (read only)
4. Peak time setting (push main knob and rotate to adjust)



5. Background current setting (push main knob and rotate to adjust)



6. Average current (read only)

5.13 GTAW welding

GTAW welding melts the metal of the workpiece, using an arc initiated from a non-consuming tungsten electrode. The weld pool and electrode are protected by a shielding gas that usually consists of an inert gas.

For GTAW welding, the welding power source shall be supplemented with:

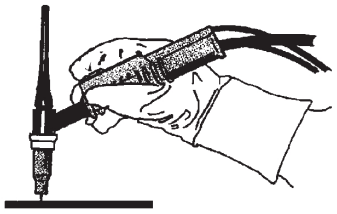
- a TIG torch
- a gas hose connected to the gas supply input (using a hose clamp)
- an argon gas cylinder
- an argon gas regulator
- a tungsten electrode
- a return cable (with clamp)

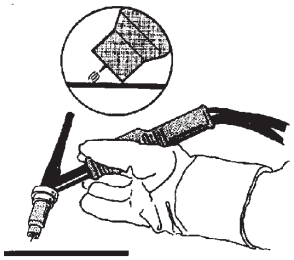
This power source performs **Lift Arc TIG** start and **TIG HG start**.

Lift Arc TIG start

The LiftArc™ function initiates the arc when the tungsten electrode is brought into contact with the workpiece, the trigger switch is pressed, and the tungsten electrode is lifted away from the workpiece. In order to minimize the risk of tungsten contaminations, the start current is very low and will slope up to the set current (controlled by the slope up function).

Place the tungsten electrode against the workpiece and press the torch trigger. When lifted away from workpiece the arc is struck at a limited current level.





TIG HF start

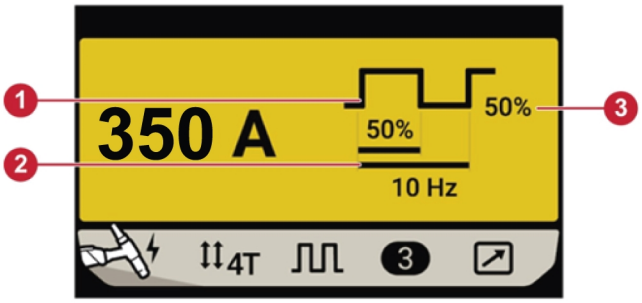
The HF start function initiates the arc by using a high frequency voltage pilot arc. This will reduce the risk of tungsten contamination in the starts. The high-frequency voltage might disturb other electrical equipment in the surrounding area.

The HF (High Frequency) start function strikes the arc by means of a spark from the tungsten electrode to the workpiece as the electrode is brought closer to the workpiece and the trigger on the GTAW torch is pressed.

5.13.1 TIG Home screen

1. Water cooler connection: water cooling symbol is displayed in status bar when water cooler is connected and activated.
2. Preset welding current: rotate main knob clockwise to increase preset welding current or anti-clockwise to decrease preset welding current.
3. TIG welding sequencer displays adjusted value of DC TIG process when sequencer view is activated or DC TIG pulse welding process when pulse and sequencer/pulse view is activated. DC TIG Pulse welding is used mainly on thin metals but can also be used on thicker material based on the application. Pulsing allows the user to control the amount of heat applied to the work piece. Pulse setting gives user far more control over the welding process without compromising the strength and integrity of the weld and helps in having a smooth and clean weld. To activate pulse or adjust value of each process, see introduction in XXX.
   To change among basic view, sequencer view or sequencer / pulse view, press menu button and enter Settings menu.
4. Bottom bar of TIG home screen displays status of welding process selection, trigger mode, pulse, job selection and remote connection. To make any change or adjustment, press the menu button and navigate through each function by rotating the main knob. See detailed introduction in XXX.

Pulse TIG home view



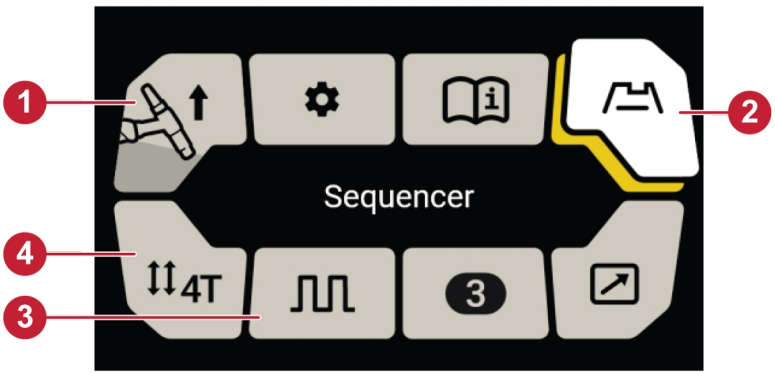
1. Peak time view
2. Frequency view
3. Background current view

Sequencer TIG home view

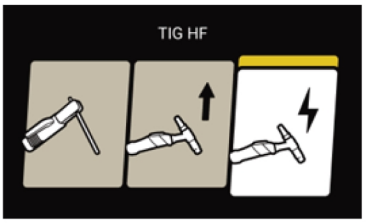
1. Gas pre-flow view
2. Start current view
3. Slope up view
4. Slope down view
5. Final current view
6. Gas post-flow view

5.13.2 TIG Menu screen

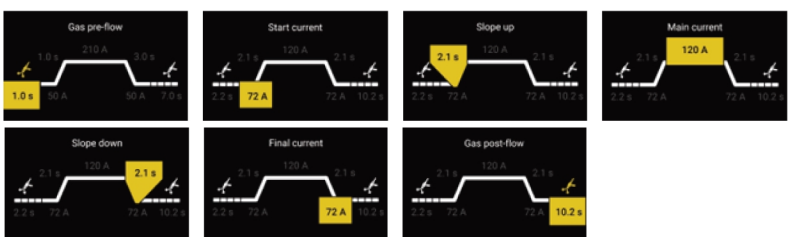
When Lift TIG or TIG HF is selected, press the menu button to enter the TIG menu screen.



1. Process selection
To press main knob to enter process selection screen and select between Lift TIG or TIG HF when this icon is highlighted.



2. Sequencer settings
Enter sequencer settings screen by pressing main knob when Sequencer icon is highlighted, and navigate through the sequencer by rotating main knob. To adjust any process, press the main knob when the process to adjust is displayed in yellow and rotate the main knob to adjust the value as displayed. Press the main knob again to confirm the value and to exit adjustment mode.



Gas pre flow

The gas pre flow function controls the time during which shielding gas flows before the arc is initiated. Setting range is 0.0–25.0 seconds. Factory default is 1.0 second.

Gas post flow

The gas post flow function controls the time during which shielding gas flows after the arc is terminated. Setting range is 0.0–25.0 seconds. Factory default is 7.0 seconds.

Slope up

The slope up function is used to control the time of the current increase in the weld initiation process to avoid any possible damage to the tungsten electrode. Setting range is 0.0–25.0 seconds. Factory default is 1.5 seconds.

Slope down

The slope down function is used to control the time of the current decrease in the weld termination process to avoid any pipes and/or cracks. Setting range is 0.0–25.0 seconds. Factory default is 3.0 seconds.

3. Pulse settings

In order to set a pulsed current, four parameters are required: pulse current, background current, pulse balance and pulse frequency.

Pulse current

The higher of the two current values when using a pulsed current. Setting range is 5 to 350 A.

Pulse background current

The lower of the two current values when using a pulsed current. Setting range is between 15% to 90% of pulsed current. Factory default is 50% of pulsed current.

Pulse balance

Pulse balance is the ratio between pulse current and background current in a pulse cycle. In order to control the energy of the arc and the size of the weld pool, pulse balance is adjustable by setting the percentage of the pulse current in a pulse cycle. Setting range is 10–90%, and increment value of each rotation of main knob is 1%. Factory default is 50%.

For example: If the pulse balance is set to 50%, the time of the pulse current and the background current will be distributed equally in the pulse cycle. If the pulse balance is set to 90%, the time of the pulse current will be 90% of the pulse cycle and the background current will only be 10%.

Pulse frequency

The amount of pulse cycles in a time period. The higher the frequency, the more pulse cycles per time period. When the pulse frequency is set low, the weld pool will have time to partially solidify between each pulse. If the frequency is set high, a more focused arc can be obtained.

Setting range is 0.01–999 Hz. Increment value at each rotation of main knob changes as listed below. Factory default setting is 10 Hz.

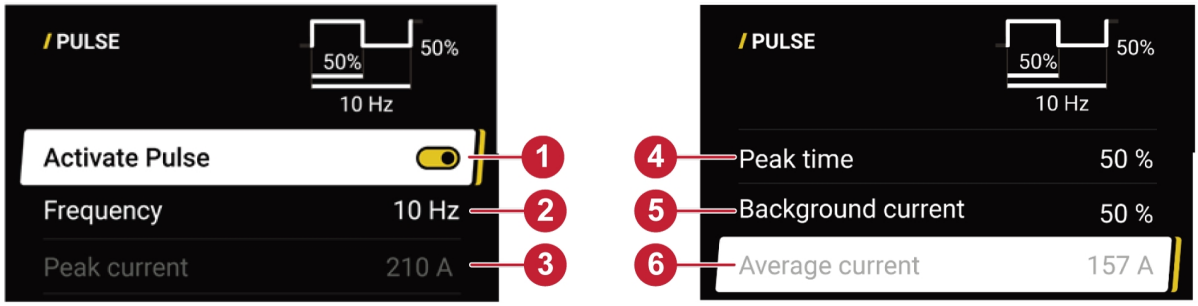
0.01–0.99: 0.01

1.0–9.9: 0.1

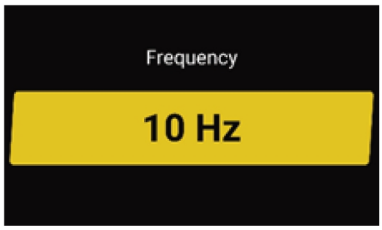
10–100: 1

100–300: 10

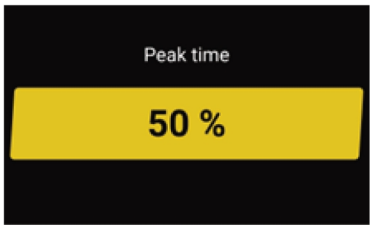
300–1000: 100



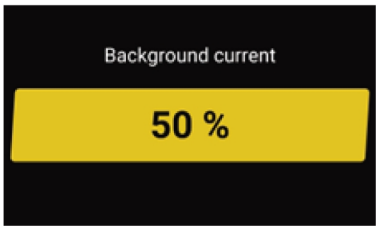
1. Pulse ON/OFF (push main knob to switch between ON and OFF)
2. Frequency settings (push main knob and rotate to adjust)



3. Peak current (read only)
4. Peak time setting (push main knob and rotate to adjust)

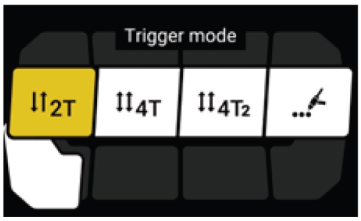


5. Background current setting (push main knob and rotate to adjust)



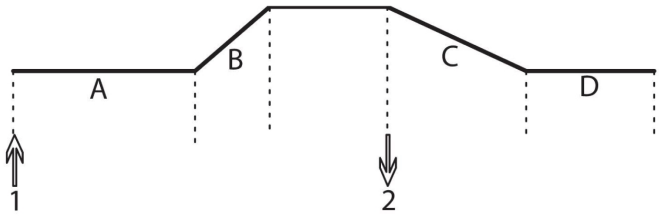
6. Average current (read only)

4. Trigger mode



2-stroke

In 2-stroke mode, press the TIG torch trigger switch (1) to start the shielding gas flow and initiate the arc. The current slopes up to the set current value. Release the trigger switch (2) to start to slope down the current and terminate the arc. The shielding gas will continue to flow in order to protect the weld and the tungsten electrode.



A = Gas pre-flow

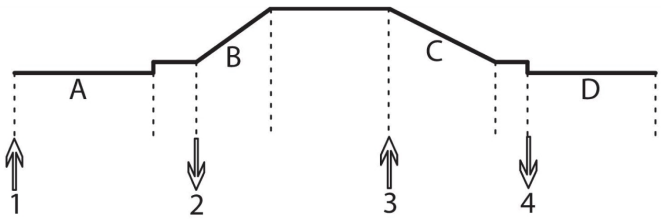
B = Slope up

C = Slope down

D = Gas post-flow

4-stroke

In 4-stroke mode, press the GTAW torch trigger switch (1) to start shielding gas flow and initiate the arc at a pilot level. Release the trigger switch (2) to slope up the current to the set current value. To stop the welding, press the trigger switch again (3). The current will slope down to the pilot level again. Release the trigger switch (4) to terminate the arc. The shielding gas will continue to flow in order to protect the weld and the tungsten electrode.



A = Gas pre-flow

B = Slope up

C = Slope down

D = Gas post-flow

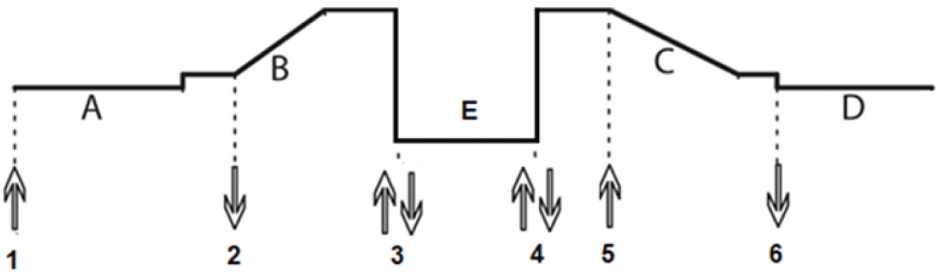
$4T_2$

4T2 changes the value of secondary current that needs to be adjusted in the sequencer after 4T2 activation. The 4T2 current feature lets the user switch to a lower current when welding the corners or edges without stopping the weld.

4T2 operation is available only in trigger mode when 4T2 is enabled.

When 4T2 mode is enabled, it can be activated by quickly tapping the trigger during welding. One quick tap on trigger (push and release) will switch the output weld current from "Main current" to "Secondary Current"; another quick tap on trigger will switch the current from "Secondary Current" to "Main Current".

See below picture.



A = Gas pre-flow

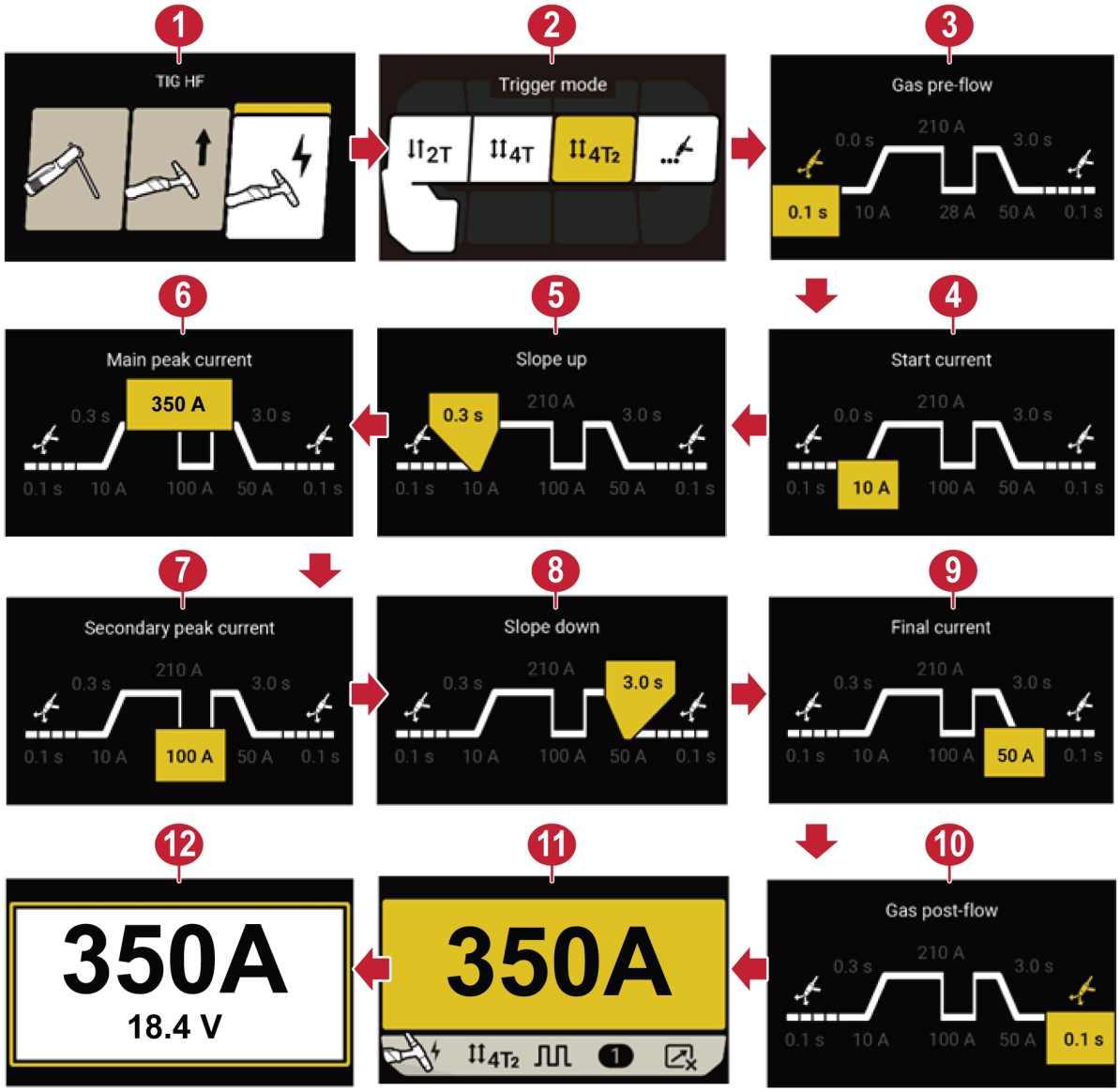
B = Slope up

C = Slope down

D = Gas post-flow

E = Secondary current

Below illustration shows the navigation or setup of 4T2 Pulse in the Pulse screen.

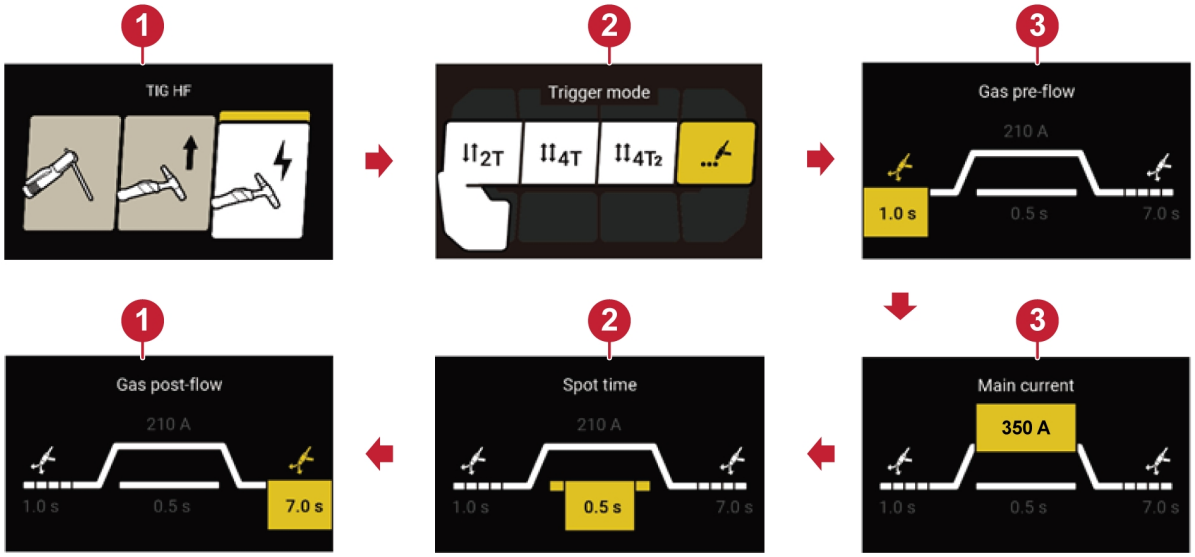


1. Weld mode selection (Lift TIG/HF TIG)
2. Select 4T2 mode
3. Pre-flow gas setting
4. Start current setting
5. Slop up setting
6. Main current setting (Current A)
7. Secondary current setting (Current B)
8. Slop down setting
9. Final current setting
10. Post-flow gas setting
11. Current setting and review
12. Welding screen

Spot Mode

Spot welding is used to weld two thin plates together at a desired location by melting the top and bottom plates together to form a nugget between them. The spot time can be adjusted in the sequencer menu once spot mode active

Below illustration shows the spot operation.

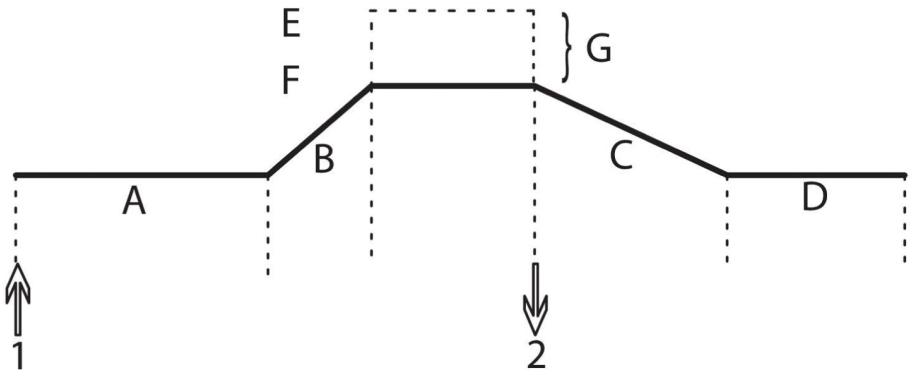


1. Weld mode selection (Lift TIG/HF TIG)
2. Select Spot mode
3. Pre-flow gas setting
4. Welding current setting
5. Spot time setting
6. Post-flow gas setting

5.14 Foot pedal functions explanation

Foot pedal with 2-stroke using TIG torch trigger

In 2-stroke mode, with the foot pedal activated, press the TIG torch trigger switch (1) to start the shielding gas flow and initiate the arc. The current slopes up to the set remote min current. Use the foot pedal to adjust the current between the remote min current and the set current value. Release the TIG torch trigger switch (2) to start to slope down the current and terminate the arc. The shielding gas will continue to flow in order to protect the weld and the tungsten electrode.



A = Gas pre-flow

B = Slope up

C = Slope down

D = Gas post-flow

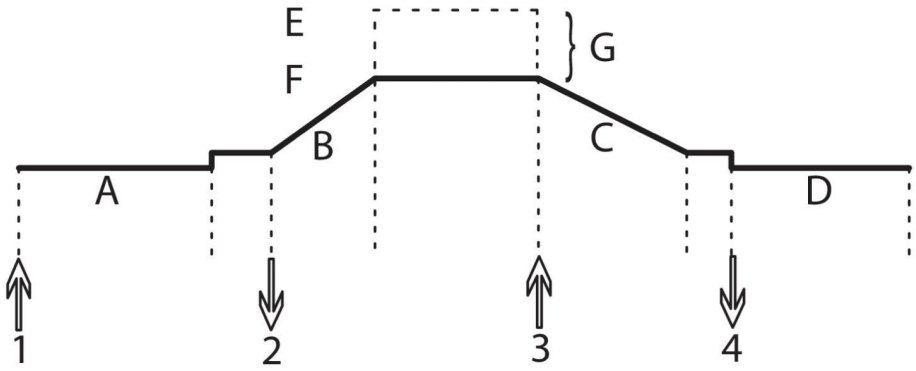
E = Set current

F = Remote min current

G = Current range adjustable by the foot pedal

Foot pedal with 4-stroke using TIG torch trigger

In 4-stroke mode, with the foot pedal activated, press the TIG torch trigger switch (1) to start the shielding gas flow and initiate the arc at a pilot level. Release the trigger switch (2) to slope up the current to the remote min current. Use the foot pedal to adjust the current between the remote min current and the set current value. To stop the welding, press the trigger switch again (3). The current will slope down to the pilot level again. Release the trigger switch (4) to terminate the arc. The shielding gas will continue to flow in order to protect the weld and the tungsten electrode.



A = Gas pre-flow

B = Slope up

C = Slope down

D = Gas post-flow

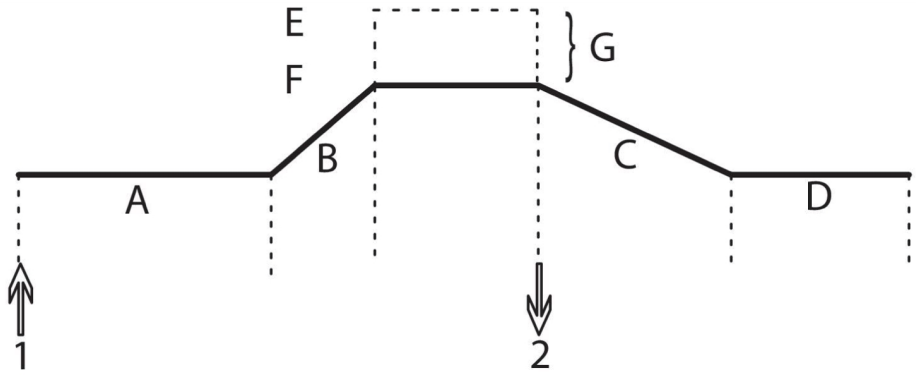
E = Set current

F = Remote min current

G = Current range adjustable by the foot pedal

Foot pedal

Press down the foot pedal (1) to start the shielding gas flow and initiate the arc. The current slopes up to the set remote min current. Use the foot pedal to adjust the current between the remote min current and the set current value. Release the foot pedal to start to slope down the current and to terminate the arc. The shielding gas will continue to flow in order to protect the weld and the tungsten electrode.



A = Gas pre-flow

B = Slope up

C = Slope down

D = Gas post-flow

E = Set current

F = Remote min current

G = Current range adjustable by the foot pedal

6 MAINTENANCE

WARNING!
The mains supply must be disconnected during cleaning and maintenance.

CAUTION!
Only persons with appropriate electrical knowledge (authorized personnel) may remove the safety plates.

CAUTION!
The product is covered by manufacturer's warranty. Any attempt to carry out repair work by non-authorized service centers or personnel will invalidate the warranty.

NOTE!
Regular maintenance is important for safe and reliable operation.

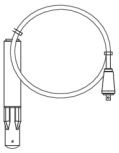
NOTE!
Perform maintenance more often during severe dusty conditions.

Before each use, make sure that the:

- Product and cables are undamaged, and
- The torch is clean and undamaged.

6.1 Routine maintenance

Maintenance schedule during normal conditions. Check equipment prior to every use.

Interval	Area to maintain		
Every 3 months	 Clean or replace unreadable labels.	 Clean weld terminals.	 Check or replace weld cables.
Every 6 months	 Clean inside equipment. Use dry compressed air with 4 bar pressure.		

6.2 Cleaning instructions

To maintain the performance and increase the lifetime of the power source, it is mandatory to clean it regularly. How often depends on:

- The welding process,
- The arc time, and

- The working environment.

CAUTION!
Make sure that the cleaning procedure is done in a suitable prepared workspace.

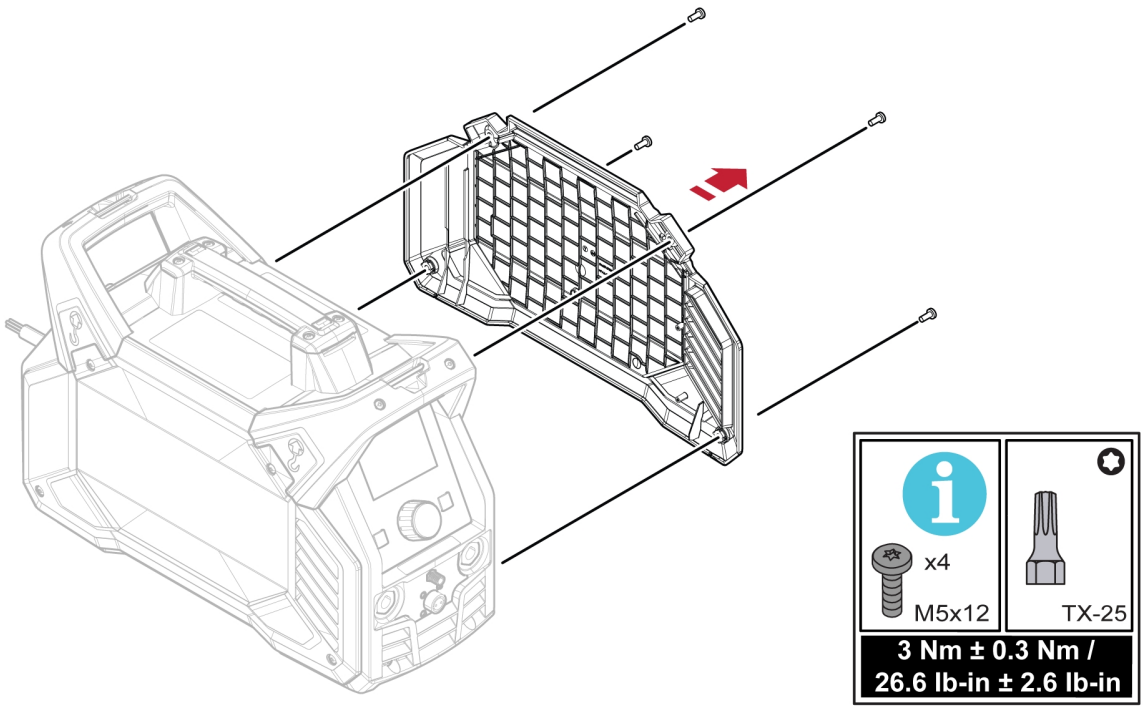
CAUTION!
During cleaning, always wear the recommended personal protective equipment, such as earplugs, safety glasses, masks, gloves and safety shoes.

CAUTION!
The cleaning procedure should be carried out by an authorized service technician.

1. Disconnect the power source from the power supply.

WARNING!
Wait at least 30 seconds for the capacitors to discharge before continuing.

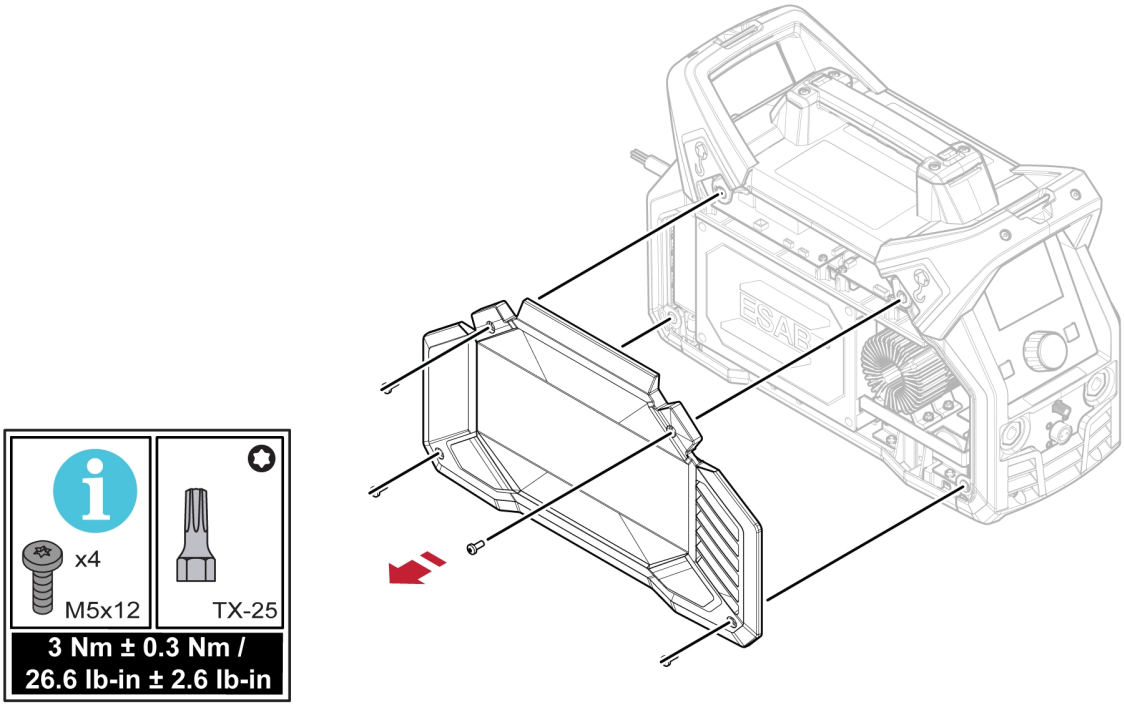
2. Remove the four screws holding the right side panel **(R)** and remove the panel.



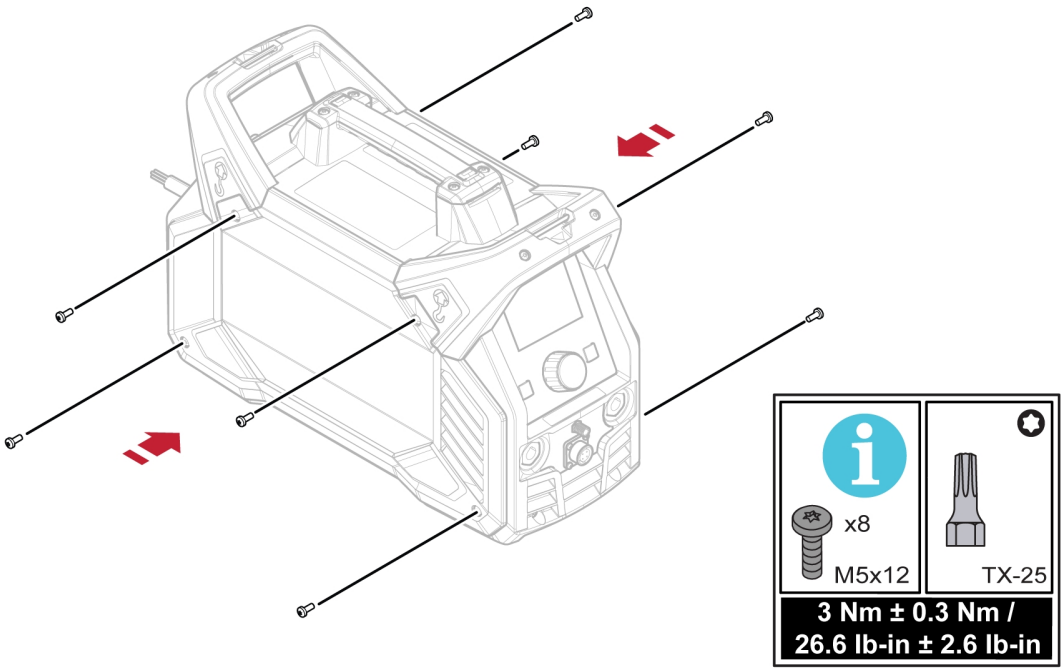
3. Clean the right side of the power source using low-pressure dry compressed air.

NOTE!
Because the power source contains one “dirty” side (the right side) and one “clean” side (the left side), it is important not to remove **the left** side panel before cleaning the right side of the power source.

4. Remove the four screws holding the left side panel **(L)** and remove the panel.



5. Clean the left side of the power source using low-pressure dry compressed air.
6. Make sure that no dust remains on any part of the power source.
7. Reassemble the power source after cleaning and perform testing according to IEC 60974-4. Follow the procedure in section "After repair, inspection and test" in the Service manual.
8. Tighten the screws on the side panels with 3 Nm ± 0.3 Nm (26.6 in lb. ± 2.6).



7 TROUBLESHOOTING

Perform these checks and inspections before sending for an authorized service technician.

- Check that power is disconnected before starting any type of repair action.

Type of fault	Corrective action
SMAW welding problems	Check that the welding process is set to MMA.
	Check that the welding and return cables are correctly connected to the power source.
	Make sure that the return clamp has good contact with the workpiece.
	Check that the correct electrodes and polarity are being used. For polarity, check electrode packaging.
	Check that the correct Welding current (A) is set.
	Adjust Arc Force and Hot start.
GTAW welding problems	Check the welding process is set for Lift TIG as necessary.
	Check that the GTAW torch and return cables are correctly connected to the power source.
	Make sure that the return clamp has good contact with the workpiece.
	Make sure that the GTAW torch lead is connected to the negative welding terminal.
	Make sure that the correct shielding gas, gas flow, welding current, filler rod placement, electrode diameter and welding mode on power source is used.
No arc	Check that the electrical power supply switch is turned on.
	Check that the display is on to verify that the power source has power.
	Check that the setting panel is displaying correct values.
	Check that welding and return cables are correctly connected.
	Check the electrical power supply fuses.
Welding current is interrupted during welding	Check whether the Over Temperature LED (Thermal Protection) on the setting panel is on.
	Continue with fault type "No Arc".
The thermal protection trips frequently	Make sure that the recommended duty cycle for the weld current has not been exceeded. See the “Duty cycle” section in the TECHNICAL DATA chapter.
	Make sure the air inlets or outlets are not clogged.
	Clean inside the machine according to the routine maintenance procedures.

8 CALIBRATION AND VALIDATION

WARNING!
Calibration and validation should be performed by a trained service technician with sufficient training in welding and measurement technology. The technician should have knowledge of hazards that may occur during welding and measurement and should take necessary protective actions!

8.1 Measurement methods and tolerances

When calibrating and validating, the reference measuring instrument must use the same measuring method in the DC range (averaging and rectification of the measured values). A number of measurement methods are used for reference instruments, e.g. TRMS (True Root Mean Square), RMS (Root-Mean-Square) and rectified arithmetic mean. Renegade ET 350iPA uses the rectified arithmetic mean value and should therefore be calibrated against a reference instrument using the rectified arithmetic mean value.

In the field application it will occur that a measuring device and a Renegade ET 350iPA may display different values even though both systems are validated and calibrated. This is due to the measurement tolerances and the method of measurement of the two measurement systems. This can result in a total deviation up to the sum of both measurement tolerances. If the measurement method differ (TRMS, RMS or rectified arithmetic mean), significantly larger deviations are to be expected!

The ESAB Renegade ET 350iPA welding power source presents the measured value in rectified arithmetic mean and should therefore not show any significant differences compared to other ESAB welding equipment, due to the measurement method.

8.2 Requirements specifications and standards

Renegade ET 350iPA is designed to meet the accuracy for indication and meters required by IEC/EN 60974-14, by definition Standard grade.

Calibration accuracies of displayed value

Arc voltage	**±1.5 V** (U_{min}–U2) under load, resolution 0.25 V (Theoretical measuring range in a Renegade ET 350iPA system is 24–60 V.)
Welding current	**±2.5%** of I2 max according to rating plate of the unit under test, resolution 1 A. The measuring range is specified by the rating plate on the used Renegade ET 350iPA welding power source.

Recommended method and applicable standard
ESAB recommend calibration and validation to be executed according to IEC/EN 60974-14(:2018) or EN 50504:2008 (unless another way of execution is communicated from ESAB).

9 ERROR CODES

Error codes indicate that a fault has occurred in the equipment. Errors are indicated by the text "Error" followed by the error code number shown in the display.

If more than one error was detected, only the code for the last occurring error is displayed.

9.1 Error code descriptions

Error codes that the user can handle are listed below. If any other error code appears, contact an authorized ESAB service technician.

Error code	Description
Error205	*Power supply fault* The power supply to the power source is too low or too high. One phase is lost during operation. **Action:** Make sure the power supply is stable, all leads are connected, and the mains voltage (all 3 phases) is OK and restart the system. If the error persists, contact a service technician.
Error206	*Temperature fault* The temperature of the power source is too high. **Action:** The error code will automatically disappear when the power source has cooled down and is ready for use again. If the error persists, contact a service technician.
Error406	*Coolant fault* The temperature of the coolant fluid is too high. **Action:** Make sure that there is sufficient coolant fluid in the cooler. The error code will automatically disappear when the coolant has cooled down and is ready for use again. If the error persists, contact a service technician.
Error429	*Water cooling disabled* The hose from the torch is not connected to the cooling unit. **Action:** If a water cooled torch is used make sure it is connected to the cooling unit. If a water cooled torch is not used, press a button on the control panel to cancel the error. If the error persists, contact a service technician.

10 ORDERING SPARE PARTS

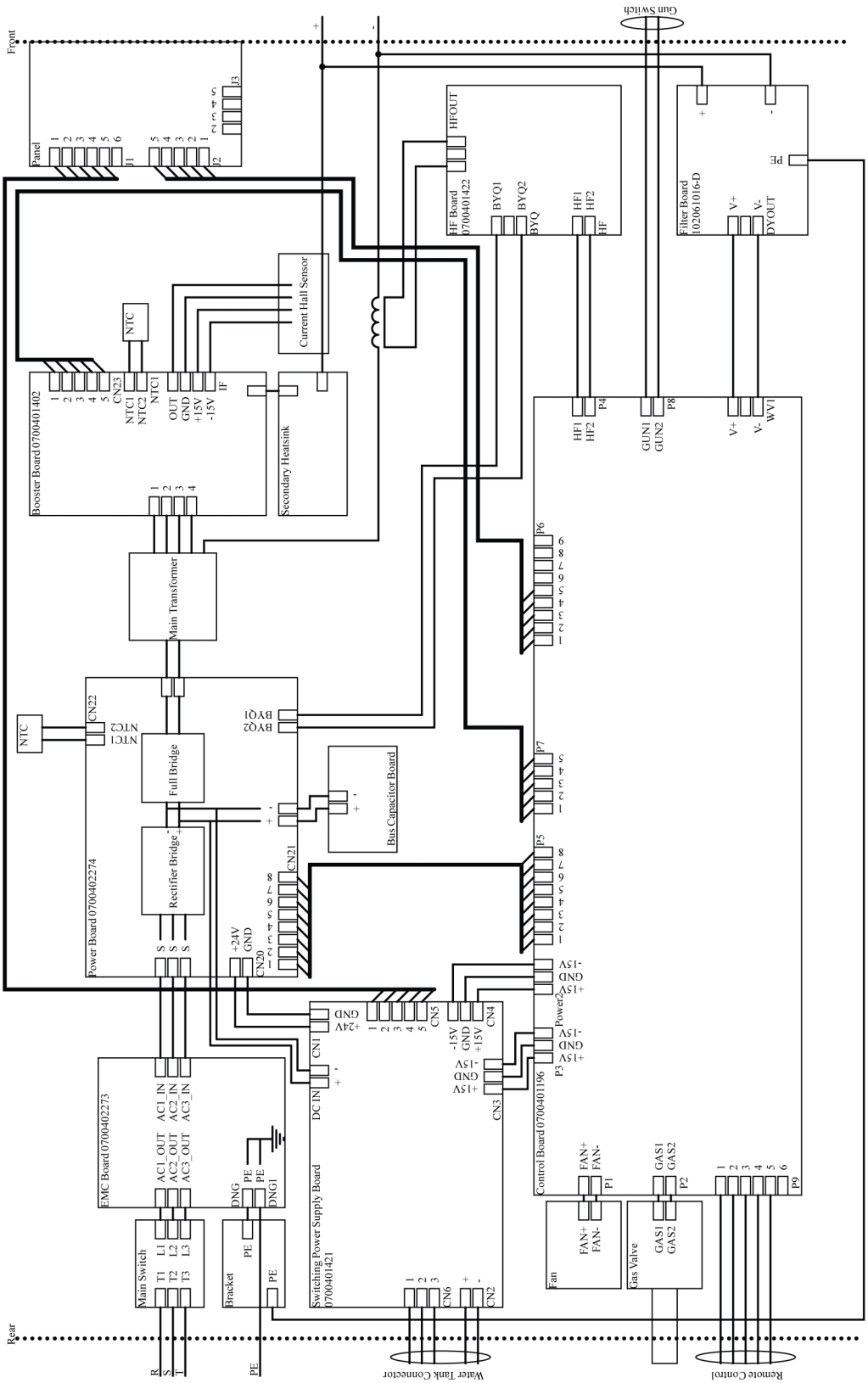
CAUTION!
Repair and electrical work should be performed by an authorized ESAB service technician. Use only ESAB original spare and wear parts.

Renegade ET 350iPA is designed and tested in accordance with the international and European standards **EN IEC 60974-1**, **EN IEC 60974-3**, and **EN IEC 60974-10**. On completion of service or repair work, it is the responsibility of the person(s) performing the work to ensure that the product still complies with the requirements of the above standards.

Spare parts and wear parts can be ordered through your nearest ESAB dealer, see **esab.com**. When ordering, please state product type, serial number, designation and spare part number in accordance with the spare parts list. This facilitates dispatch and ensures correct delivery.

APPENDIX

WIRING DIAGRAM



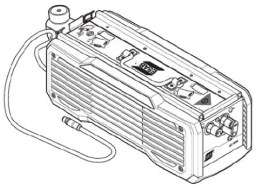
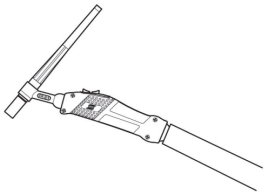
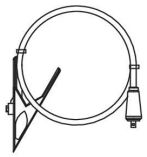
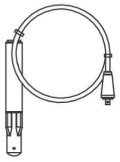
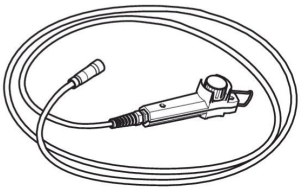
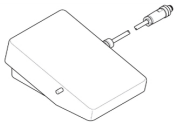
ORDERING NUMBERS

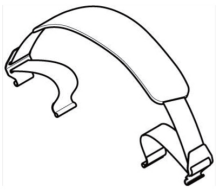
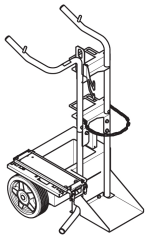
Ordering number	Denomination	Type	Region
0700 402 401	Welding power source	Renegade ET 350iPA	Non-CE

The three last digits in the document number of the manual show the version of the manual. Therefore they are replaced with * here. Make sure to use a manual with a serial number or software version that corresponds with the product, see the front page of the manual.

Technical documentation is available on the Internet at: **www.esab.com**

ACCESSORIES

0445 045 881	Water Cooler EC 1001	
0700 026 240 0700 026 241 0700 026 254 0700 026 255 0700 026 290 0700 026 291 0700 026 294 0700 026 295 0700 026 298 0700 026 299	Exeor TIG SR X26, 4 m Exeor TIG SR X26, 8 m Exeor TIG SR X26-R, 4 m Exeor TIG SR X26-R, 8 m Exeor TIG SR 21, 4 m Exeor TIG SR 21, 8 m Exeor TIG SR 21-R, 4 m Exeor TIG SR 21-R, 8 m Exeor TIG SR 21-R, 12 m Exeor TIG SR 21-R, 16 m	
Return cable kits		
0700 006 903 0700 006 889	Return cable kit, OKC 50, 3 m Return cable kit, OKC 50, 5 m	
0700 006 902 0700 006 888 0700 006 890	Electrode holder kit, Handy 300, OKC 50, 3 m Electrode holder kit, Handy 300, OKC 50, 5 m Electrode holder kit, Handy 400, OKC 50, 5 m	
0700 500 084 0700 500 087	Remote control, MMA 4 (10 m) Remote control, MMA 4 (25 m)	
W4014450	Foot pedal with 4.5 m (15 ft) cable, 8 PIN	

0445 197 880	Shoulder strap	
0460 330 881	Trolley	

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