

Plate Butt Welding Station PEMA PBW 5000/2

Instruction Manual

Author: TLe

Code-Revision: D23399-0

Date: 8.1.2015

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1 INTRODUCTION

	 CAUTION 	
	Read and understand the INSTRUCTION MANUAL before installing or operating!	

- Observe the following safety precautions in addition to the standard regulations that apply to the work place.
- Operator has the ultimate responsibility for ensuring that anyone who works with or near the equipment observes all the relevant safety precautions.
- All work must be carried out by trained personnel who are familiar with the operation of the equipment.
- Incorrect operation of the equipment may lead to a hazardous situation which can result in injury to the operator and damage to the equipment.
- Anyone who uses the equipment must be familiar with
 - its operation
 - the location of the emergency stop
 - its function
 - relevant safety precautions
- Before starting the operation
 - make sure that no unauthorized person is stationed within the working area.
 - appropriate fire extinguishing equipment is clearly marked and close at hand
- The work place must
 - be suitable for the purpose
 - be free from draughts
- Protect yourself and others!
- In case of malfunction call immediately for expert assistance!
- **Keep this manual for future reference.**

1.1 Contact information

Manufacturer:

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Service:

Tel: +358 2 760 77 200
E-mail: service@pemamek.com

Internet:

www.pemamek.com

2 SAFETY

2.1 General Information

The plate butt welding line works as a push through system. The welding stations are very open and the operator can walk on panel, so no extra platform is needed. Welding station has a magnet clamping system in welding table and side positioning devices for fixing the plates to the right position. Welding table has hydraulic pre-bending function. Welding carriage is mounted to PEMA PBW-5000 welding portal in top of welding table.

Conveyor system is integrated with welding tables to feed plates through the system.

Integration with milling machines including plate push and measurement carriage of MM1 has been considered in this offer and in case of milling machine supplier other than PEMA specification of conveyor line has to be reviewed.

Pema plate butt welding portal has one fixed main beam mounted in top of welding table. Beam is standing with own legs on the floor. Welding carriage is moving along the beam. Tandem SAW welding head and flux handling equipment is mounted on the beam.

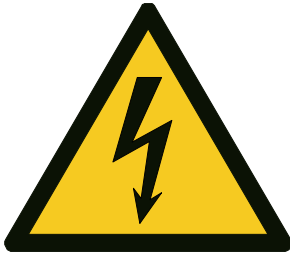
The machine is intended for industrial and for indoor use only.

In case you intend to use the equipment for any other purpose, please confirm the suitability from the manufacturer or his representative.

Any modification made to the construction of the machine can yield to a hazard and will terminate the warranty.

2.2 Safety Instructions

	 DANGER  MOVING MACHINE – Crushing Hazard	
Secure the working area before driving the machine!		
	 WARNING  CLIMBING AND WORKING ON WELDING PORTAL – Falling Hazard!	
- Use fall protection equipment! - Check the condition of the fall protection equipment before use according to the manufacturer's instructions. - Remove noticed defects immediately! - Keep the platform clean from idle objects!		
	 WARNING  NOISE – Excessive noise can damage hearing	
- When noise level emissions reach 80 dB (A) or above it can damage hearing. - Protect your ears. Use earmuffs or other hearing protection. - Warn bystanders of the risk.		

	! WARNING ! ELECTRIC SHOCK - can kill	
• Install and earth the welding unit in accordance with applicable standards. • Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing. • Insulate yourself from earth and the work piece. • Ensure your working stance is safe. • Disconnect main power before service or maintenance.		

	! WARNING ! ARC WELDING AND CUTTING can be injurious	
• Take precautions when welding. • Ask for your employer's safety practices which should be based on manufacturer's hazard data. • Make sure the welding ground cable is connected securely. • Read the safety instructions supplied with the welding equipment. • DO NOT lubricate or service the welding equipment during the use.		

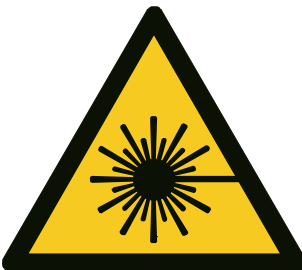
	 WARNING  FUMES AND GASES – can be dangerous to health	
• Keep your head out of the fumes. • Use ventilation, extraction at the arc, or both, to keep fumes and gases from you breathing zone and the general area.		

	 WARNING  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.		

	 WARNING  WELDING SPARKS – Fire hazard	
• Ensure there is no inflammable material nearby. • Ensure there is fire extinguishing equipment clearly marked and close at hand.		

	! WARNING !	
	HOT WORK PIECE – can burn	
• The work piece can be hot after welding or cutting. • Use personal safety equipment.		

	! WARNING !	
	MOVING WORK PIECE – entanglement and crushing hazard	
• Secure the working area before operating! • Do not go near or under the moving work piece!		

	! WARNING !	
	LASER RADIATION – Can injure eyes	
• DO NOT have direct viewing of the beam. • Ensure there are no reflections from mirror-like surfaces. • Protect your eyes from laser radiation. • Protect bystanders from laser radiation. • Turn the laser off with key switch when the sensor head is not pointing at a work piece. • Class 3B device		

	! WARNING ! BREAKDOWN OF THE PNEUMATIC EQUIPMENT – Loss of sight or hearing and impact hazard	
• Check the condition of the pneumatic system regularly and repair all failures immediately. • Repair all damaged components immediately. • Use appropriate personal protective equipment.		

	! WARNING ! IN CASE OF AN EMERGENCY – Stop machine with emergency stop button!	
• Emergency stop buttons are used in case of an emergency. • Do not use emergency stop buttons for normal stopping of machine. • Ensure safe working conditions before starting operation after emergency stop!		

2.3 Safety related functions

In case of an emergency the operation of the machine is stopped with emergency stop. The reason for emergency must be solved before continuing operation.

All emergency stop buttons have similar function and stop the whole line.

After clearing the reason the emergency stop can be reset with a push button in the main control panel.

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3 TECHNICAL INFORMATION

3.1 Machine structure

Pema PBW 5000/2 welding station consists of the following main parts:

1. Portal
2. Welding equipment
3. Coil stand
4. Ladder
5. Service platform
6. Flux tank
7. Electric cabinet
8. Control panel

Location of the main parts is shown in Figure 1

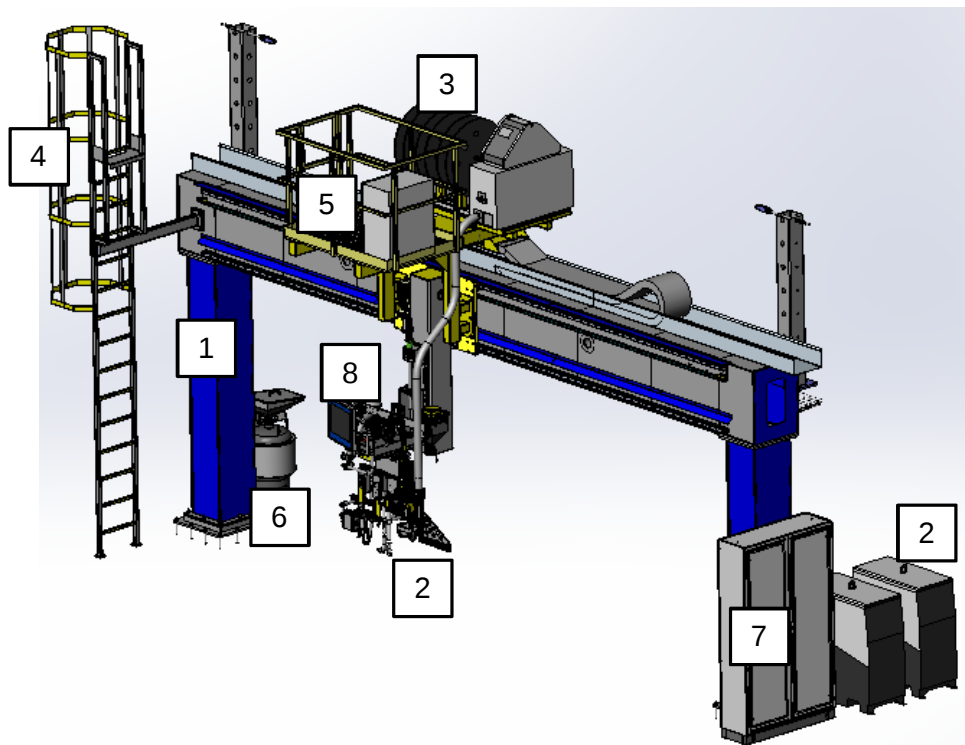


Figure 1 Main parts

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3.2 Technical Data

3.2.1 Mechanical characteristics

Welding movement	5 000 mm
Height	5 365 mm
Width	8 625 mm
Weight	103 010 kg
Wire reels	3 x 100 kg
Cross slides	600 x 300 mm

3.2.2 Electrical characteristics

Main supply voltage	400 VAC / 50 Hz 3ph + N + PE
Power consumption	
- Main cabinet	45 kVA
- Magnet cabinet	10 kVA
- 2 x PW1000 SD	90 kVA
- Induction heater	127 kVA
- Chiller	10 kVA
Required fuse size	
- Main cabinet	80 A (Slow)
- Magnet cabinet	32 A (Slow)
- 2 x PW1000 SD	100 A (Slow)
- Induction heater	100 A (Slow)
- Chiller	32 A (Slow)
IP protection class	IP 54

3.2.3 Noise level

A-weighted sound power level	dB
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3.3 Machine plate

Machine plate is attached to the side of the main control cabinet.

 Pemamek Oy Ltd. FIN-32200 Loimaa Finland www.pemamek.com	Type:		   701110-1
	Ser.No:		
	Art.No:		
	Man.Year:		
	Weight:		
	ph	Hz	
		V	
		A	
	kVA		

The machine plate contains the following important information:

Type:	Type of the machine
Ser. No:	Serial number of the machine
Art. No:	Article number of the machine
Man. Year:	Manufacturing year of the machine
Weight:	Weight of the machine
ph	Mains supply number of phases
Hz	Mains supply frequency
V	Mains supply voltage
A	Mains supply fuse size
kVA	Power consumption of the Machine

	 NOTICE  Read and Understand the INSTRUCTION MANUAL before installing or operating	
	• The weight in the machine plate does not include accessories! • Always mention the type, serial number and manufacturing year of the machine when ordering spare parts.	

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4 INSTALLATION AND COMMISSIONING

	! CAUTION !	
	Read and understand the INSTRUCTION MANUAL before installing or operating!	
• Observe the following safety precautions in addition to the standard regulations that apply to the work place. • Read all relevant manuals and safety precautions carefully before starting to unpack and install the equipment. • Ensure installation is carried out by suitable trained personnel. • Check the machine weight from the technical data before lifting the machine. • Observe and obey the lifting instructions that apply to the work place. • Protect yourself and others!		

4.1 Handling and storing

The machine parts are packed on a basis, suitable for lifting by crane and/or forklift. Use only the designated lifting loops to lift up the machine.

Unload the machine from the packing and check the outer condition. Do not store the machine outside or in damp places.

4.2 Installation and start-up

Installation of Pema PBW welding station is only allowed under the supervision of PEMA or its authorized representative. Installation must be carried out according to installation instructions in Pema lay-out and foundation drawings.

5 OPERATING INSTRUCTIONS

	! CAUTION !	
	Read and understand the INSTRUCTION MANUAL before installing or operating!	
• Observe the following safety precautions in addition to the standard regulations that apply to the work place. • Operator has the ultimate responsibility for ensuring that anyone who works with or near the equipment observes all the relevant safety precautions. • Only a trained person is allowed to operate the machine. • In case of an emergency stop the operation with emergency stop button! • Ensure safe working conditions before starting operation after emergency stop! • Before operation: ○ Secure working area ○ Ensure proper fastening of work piece ○ Ensure the connection of welding ground cables. ○ Check the program parameters. ○ Check the condition and location of welding torch. • Never leave machine unattended when operating! • Protect yourself and others!		

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	! DANGER ! COLLISION – can break the equipment and cause injury!	
• Secure the working area before operating the machine! • In case of collision stop operation immediately and check possible damages.		

5.1 Safety functions

In case of an emergency the operation of the machine is stopped with emergency stop. The reason for emergency must be solved before continuing operation.

5.1.1 Emergency stop function

Emergency stop switches off all machine functions.
Emergency stop also switches off the welding equipment.

Note1: The control voltage (24VDC) is remains after emergency stop!

Note2: The power of the flux heating system remains after emergency stop!

5.1.2 Emergency stop reset

Before resetting the emergency stop all actuated emergency stop buttons must be released.
Emergency stop button is released by turning it clockwise.

5.1.3 Control panel in MC1

In the door of the main control cabinet there is a control panel for controlling the main movements of the machine.

Control panel in MC1 is shown in Figure 2 and it has the following functions:

1. Emergency stop button
2. Flux pressure tank on/off
 - a. Signal light is lit when pressure tank is enabled.
3. Emergency stop reset / PBW
4. Emergency stop reset / Conveyor

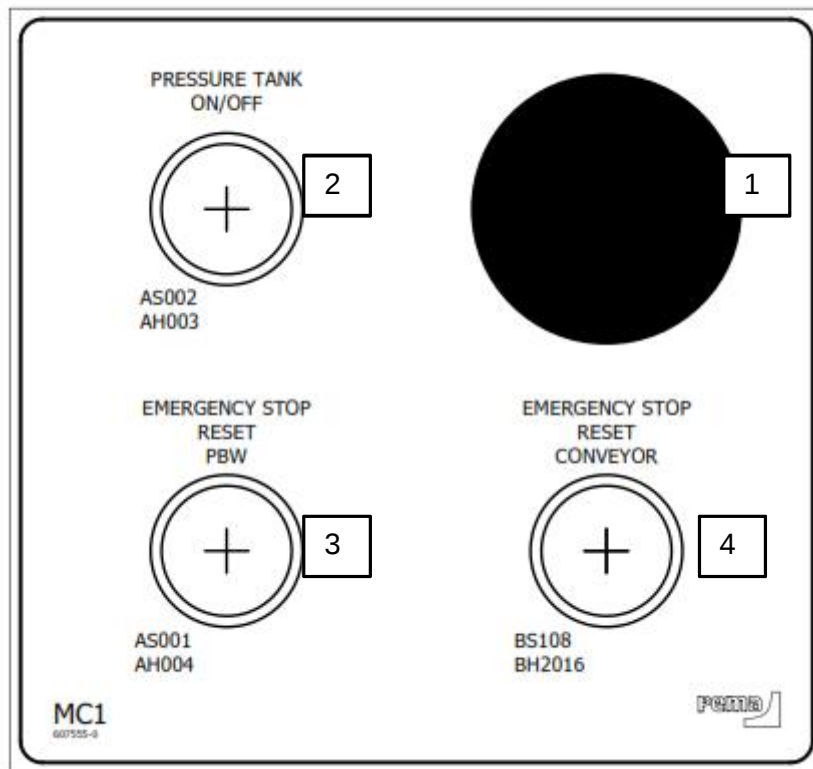
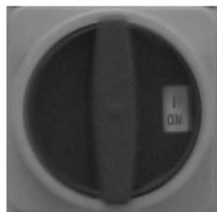


Figure 2 Control panel in MC1

5. Main switch

- On; turn clockwise (green signal light is lit, reset light is lit in few minutes after start)
- Off; turn counterclockwise (green signal light turns off)



5

5.1.4 Control panel RCA1

Functions of the welding heads and motorized cross slide are controlled with control panel RCA1.

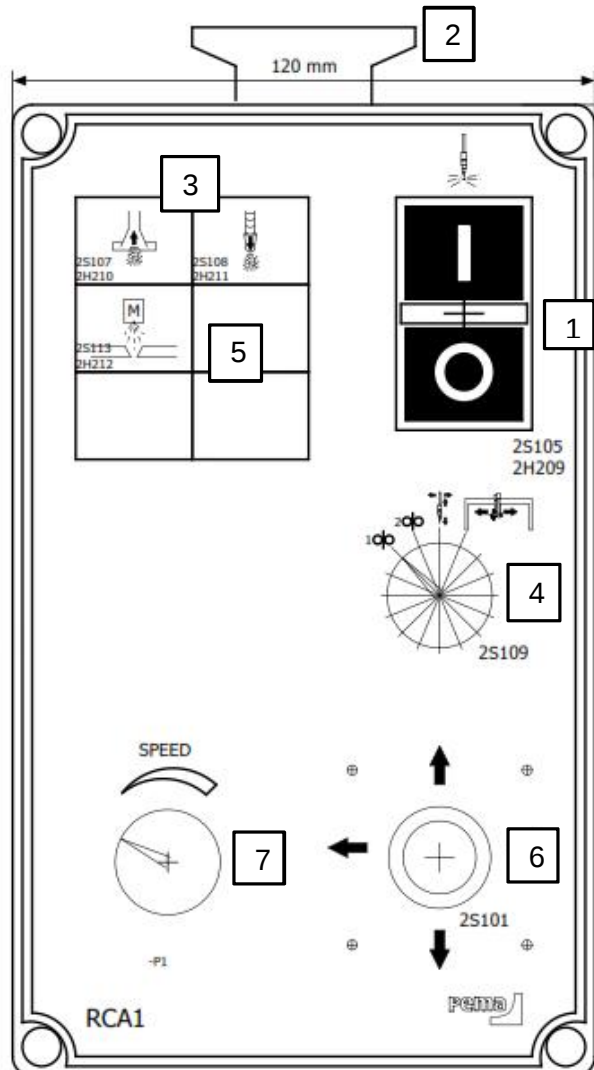


Figure 3 Control panel RCA1

1. Automatic welding Start / Stop
 - Signal light is lit when the automatic working cycle is on
 - Welding is stopped by pressing Stop button 3 seconds
 - WeldControl fault codes are reset by pressing Stop button for 3 seconds
2. Emergency stop button
3. Flux suction and Flux drop
4. Selection switch for manual movement
 - a. Torch longitudinal manual movements forward/ backward
 - b. Manual up/down/left/right for torches

- c. Manual wire feeding torch
- d. Movement of welding carriage
- 5. Seam tracking sensor activation
 - Light is flashing when seam is lost
 - Light stays continuously on when laser is ready and tracking
- 6. Joystick for selected movement
- 7. Manual speed control potentiometer for selected movement

5.1.5 Welding control

Control of the welding process as well as movements of the boom is done with touch screen called operator's panel OP1. Operator's panel is seen in Figure 4.

Operator's panel OP1 is situated on the movable stand with camera monitor. In this section it is told the main principles of how the touch screen works, programming functions are described in the following sections.



Figure 4 Operator's panel OP1

This screen is used as display to follow welding process and welding parameters as well as use it as a keypad to change welding parameters and control other functions. This is done by touching the number fields of the display.

Further instructions about programming with operator's panel are given in chapter Operation and programming functions.

5.1.6 Flux system control

Flux system has its own main switch. This makes it possible to keep the flux warm while other devices are switched off.

There are signal lights serving information about the functioning of flux pressure tank within the control panels MC1 and RCA1. If pressure tank is enabled, signal light in control panel in MC1 is on. Functioning of flux suction and flux drop is indicated with signal lights in control panel RCA1. Flux system is operated with buttons in operator's panel OP1.



The pressure tank on / off.



Flux dropping manually on / off (same function than with remote control RCA1 button).



Flux vacuuming manually on / off (same function than with remote control RCA1 button).

The pressure tank is providing welding head with flux. The recovery system will take the excess flux to the hopper where it is mixed with new flux from the tank. When the tank is empty the hopper acts as an intermediate storage allowing the operator to fill the tank without stopping the welding process.

When flux pressure is switched on, the suction valve is also activated for 1 min, in order to create a counter pressure to the flux hopper. This procedure prevents possible clogs to the hopper system.

Adjustments of the tank heater are done with tank's own thermostat (see section Flux heating adjustment).

5.2 Adjustments

5.2.1 Flux heating adjustment

Flux system has its own main switch. This makes it possible to keep the flux warm while other devices are switched off.

Flux heating control panel is used to adjust heat of the flux tank. Heating keeps the moisture out from the flux pressure tank while it is in use. When flux system is not in use, empty all flux from the tank and hoses. If flux gets too damp, it is necessary to replace the moist flux with dry.

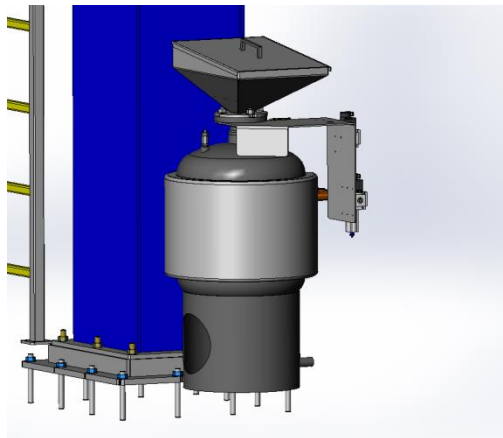


Figure 5 Flux pressure tank



Figure 6 Flux heating control

5.2.2 Adjusting contact jaw nozzle

When wire size is changed, contact jaw nozzle has to be adjusted. Adjustment screw is located on connector tube in welding head.

1. Adjust correct spring load to contact nozzle by fully tightening screw and then opening one round.
2. Check that there is washer under the upper bolt and jaw is contacting to wire only from the end of the nozzle.

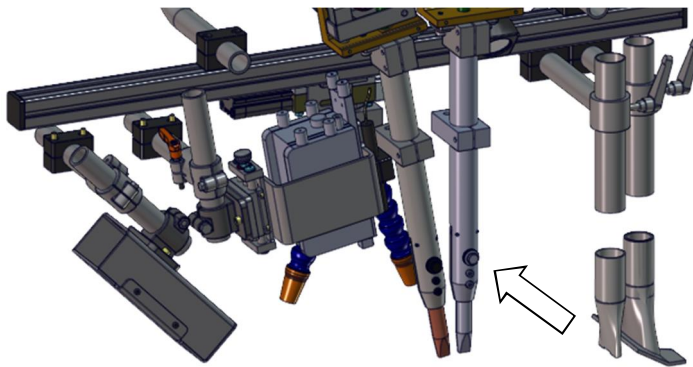


Figure 7 Adjustment screw of contact jaw nozzle

5.2.3 Adjusting wire feeder

When wire size is changed, wire feeder has to be adjusted. Adjustment screw is located in welding head next to feed roller.

1. Tighten correct spring load to wire feeder according wire size.
2. In case of twin wire check that both wires run with same speed and curled wire roll leaves teathed marks for both wires.

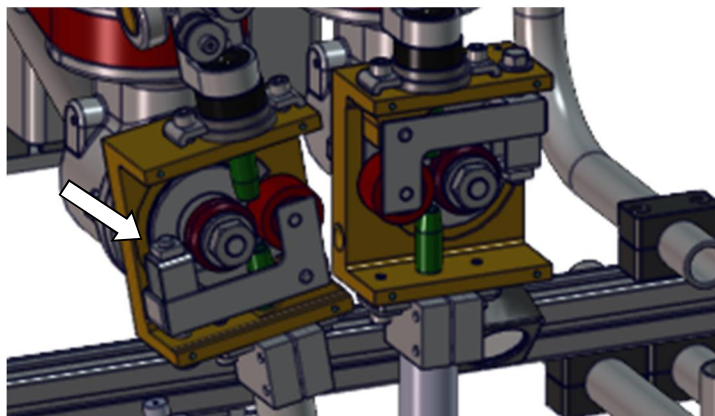


Figure 8 Adjustment screw of wire feeder

5.2.4 Adjusting wire straightener

Wire is kept straight with wire straightener. Wire straightener is located on welding head above wire feeder.

1. Move adjustment roll with adjusting wheel.

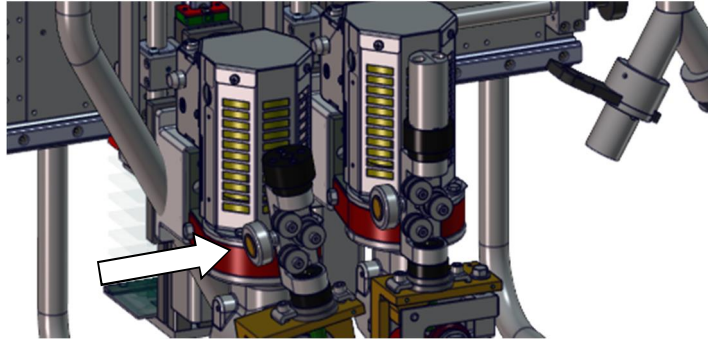


Figure 9 Adjusting wheel of wire straightener

6 OPERATION AND PROGRAMMING FUNCTIONS

6.1 System overview WeldControl 500

WeldControl 500 is an advanced user interface for controlling Pema welding applications. It utilizes META laser seam tracking sensor to enable accurate multipass welding functions. WC500 enables users to store multiple different welding parameter sets and multipass tables for different applications and switch and modify them with ease.

6.1.1 Startup

WeldControl 500 user interface should start automatically when the system is powered up, but in case it fails to start or was shut down it can be started by clicking a shortcut titled 'AUI' on the desktop. If the shortcut is not present, it can be recreated to start AUI.exe in folder C:\Pema\WeldControl 500\

6.1.2 Shutting down

It is recommended that the user interface and the operating panel should be shut down before the system is powered down to ensure that all data is properly saved and the system is shut down in a controlled manner.

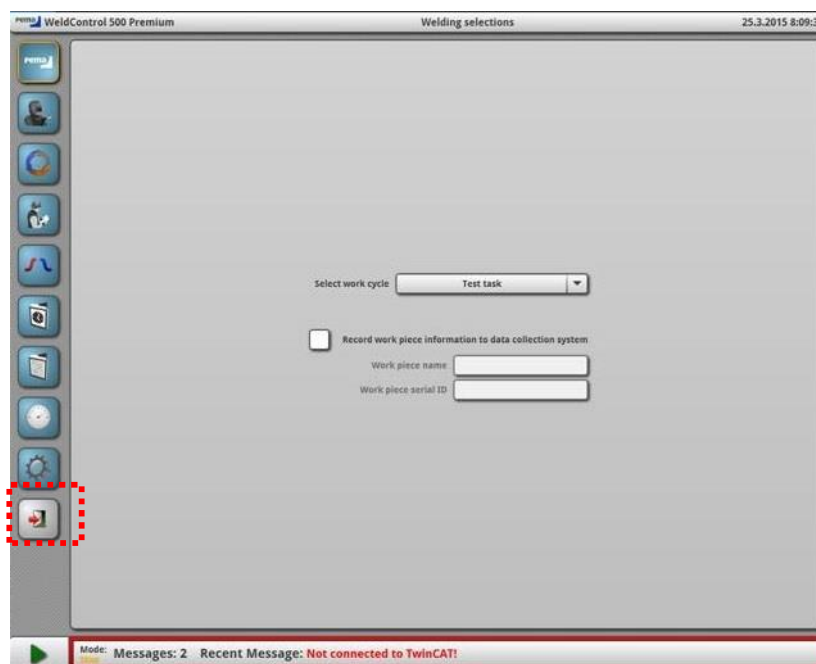


Figure 10 WC500 shutdown button

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6.1.3 MAF

The system utilizes META DLS sensor for seam tracking. The sensor communicates with META MAF application which in turn communicates with the WeldControl 500 system. MAF is started automatically when the user interface starts. MAF is parameterized and operated through WC500 user interface and usually requires no attention from the user.

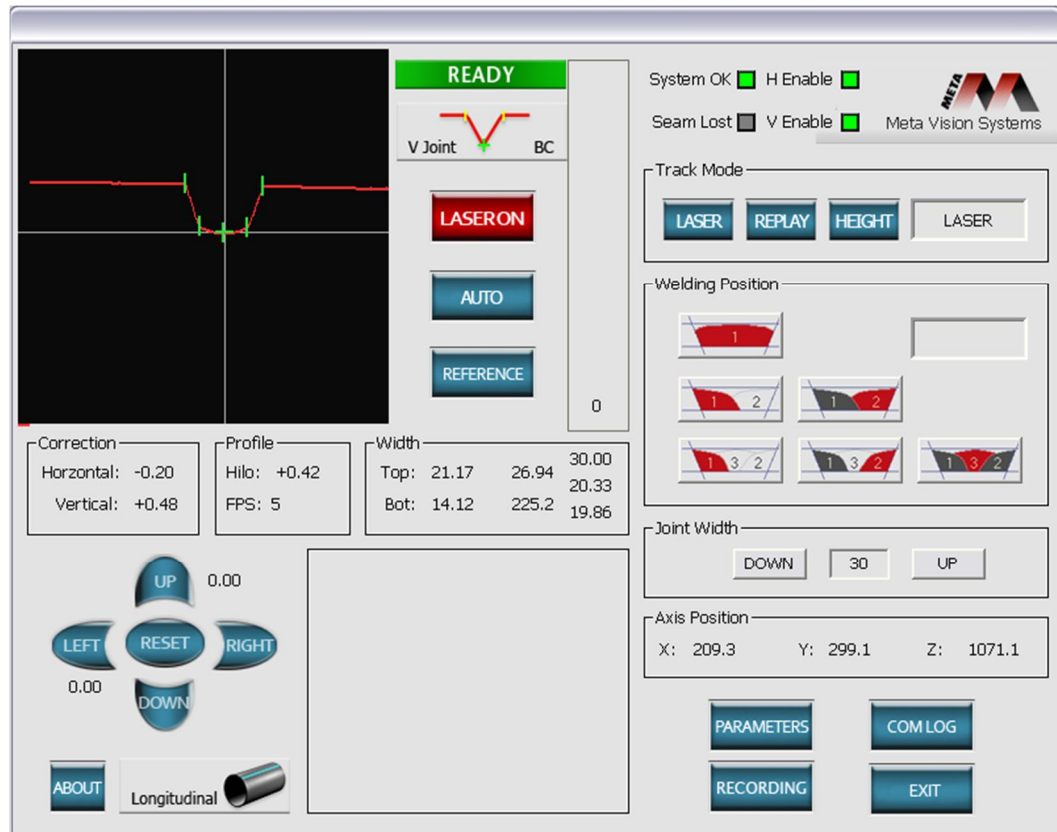


Figure 11 MAF

6.2 User interface pages and functions

The user interface can be used with a keyboard and mouse and/or with touch screen and software keyboard. The following chapter introduces the different pages and their functions in the user interface.

6.2.1 Sidebar and general UI functions

Sidebar is used to navigate between different main pages in the user interface.

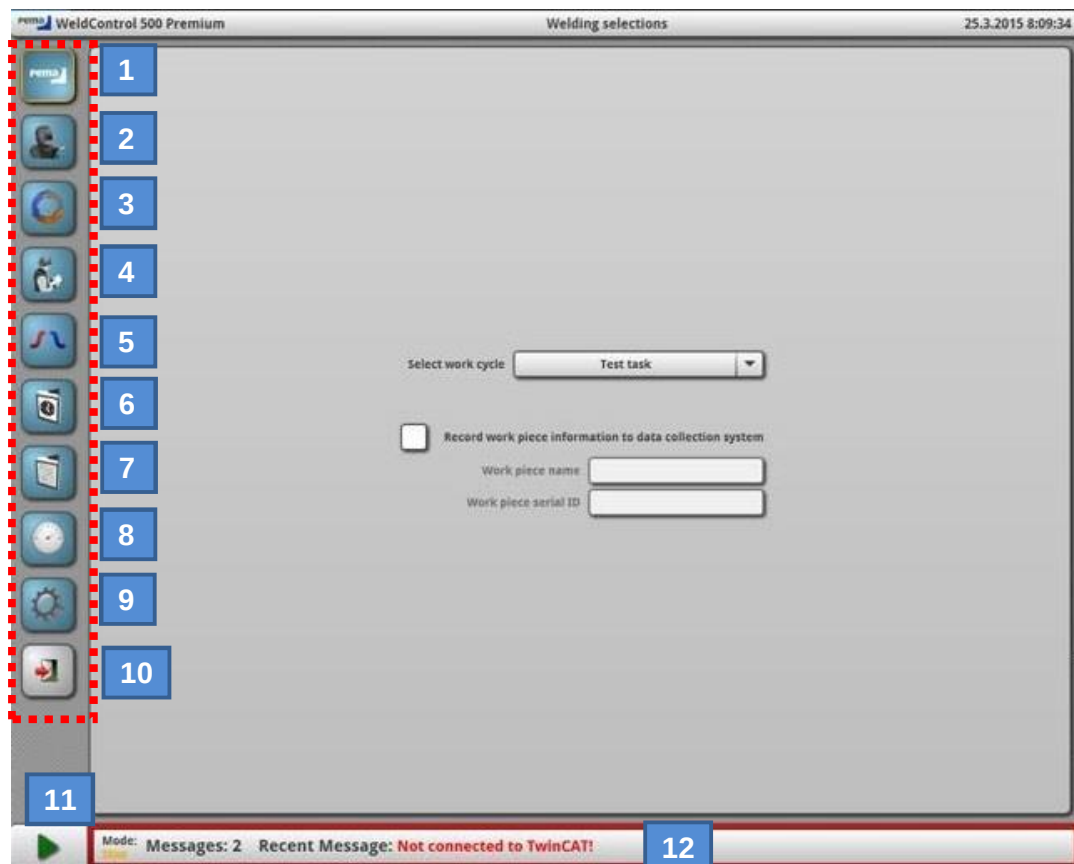


Figure 12 WeldControl 500 sidebar

1. Go to start page
2. Go to operator page
3. Go to work cycle editor page
4. Go to WPS editor
5. Go to start / stop parameter editor
6. Go to data collection page
7. Go to system messages page

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8. Machine parameter editor
9. Go to service page
10. Shut down WC500
11. Load selected settings and enable automatic mode. Play mode is active when yellow square is displayed instead of green triangle. Press again to disengage play mode.
12. Text field for displaying active message

6.2.2 Start page

The start page shows work cycle selection.

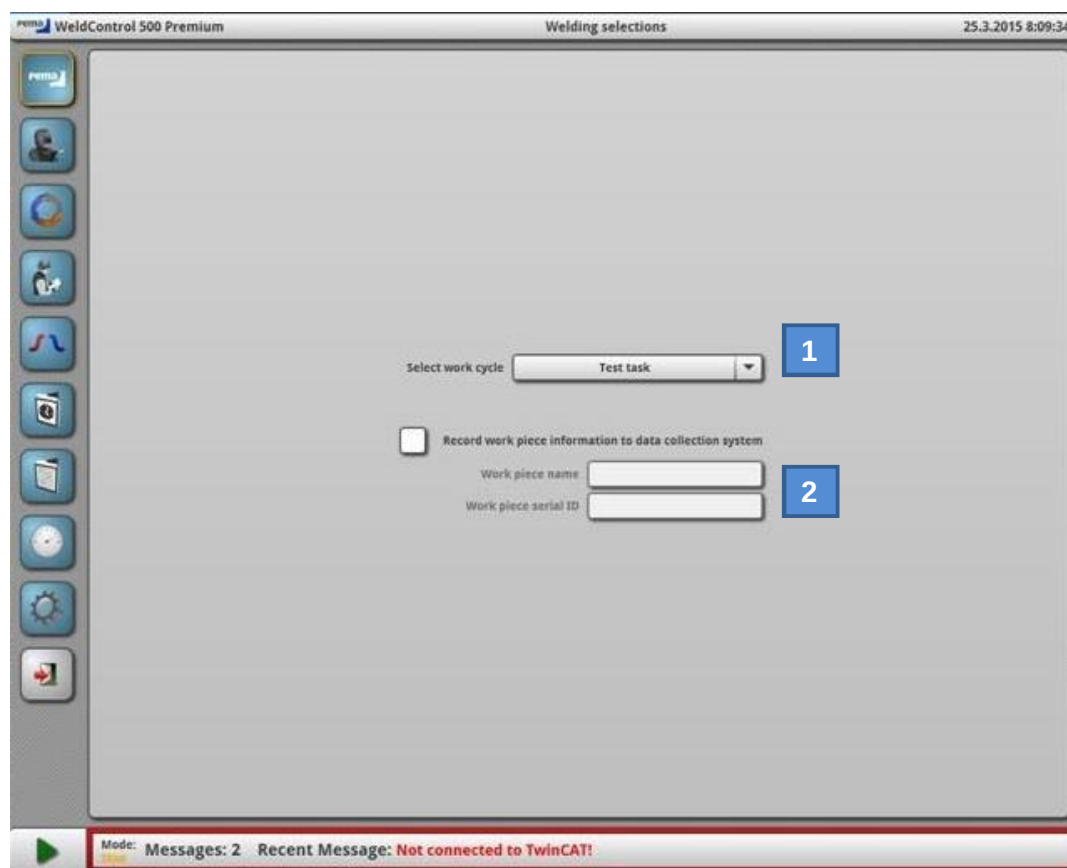


Figure 13 Start page, work cycle selection

1. Work cycle selection
2. Data collection on/off and work piece information

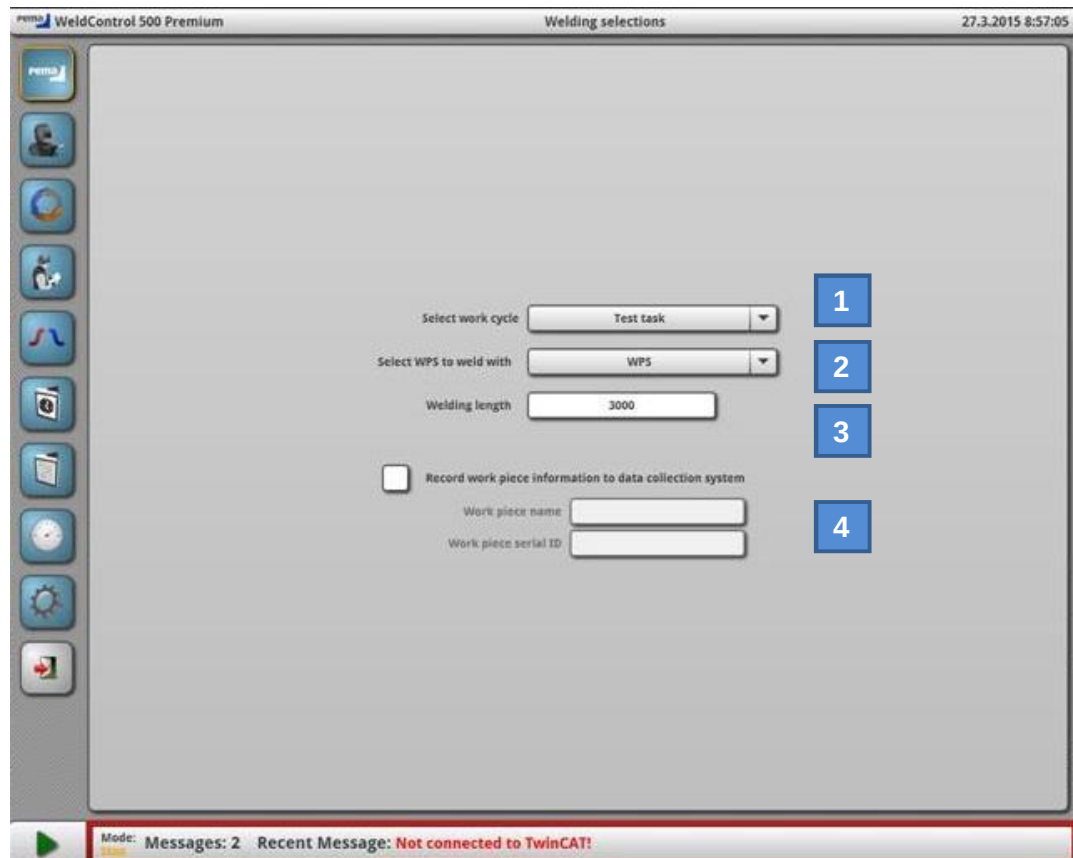


Figure 14 Start page WPS selection / Welding length selection

If selected from work cycle page

1. Work cycle selection
2. WPS selection
3. Welding length selection
4. Data collection on / off and work piece information

6.2.3 Operator page

Operator page displays information about the welding process, seam tracking and the progress of the multipass table. It also contains general equipment settings in the settings tab.

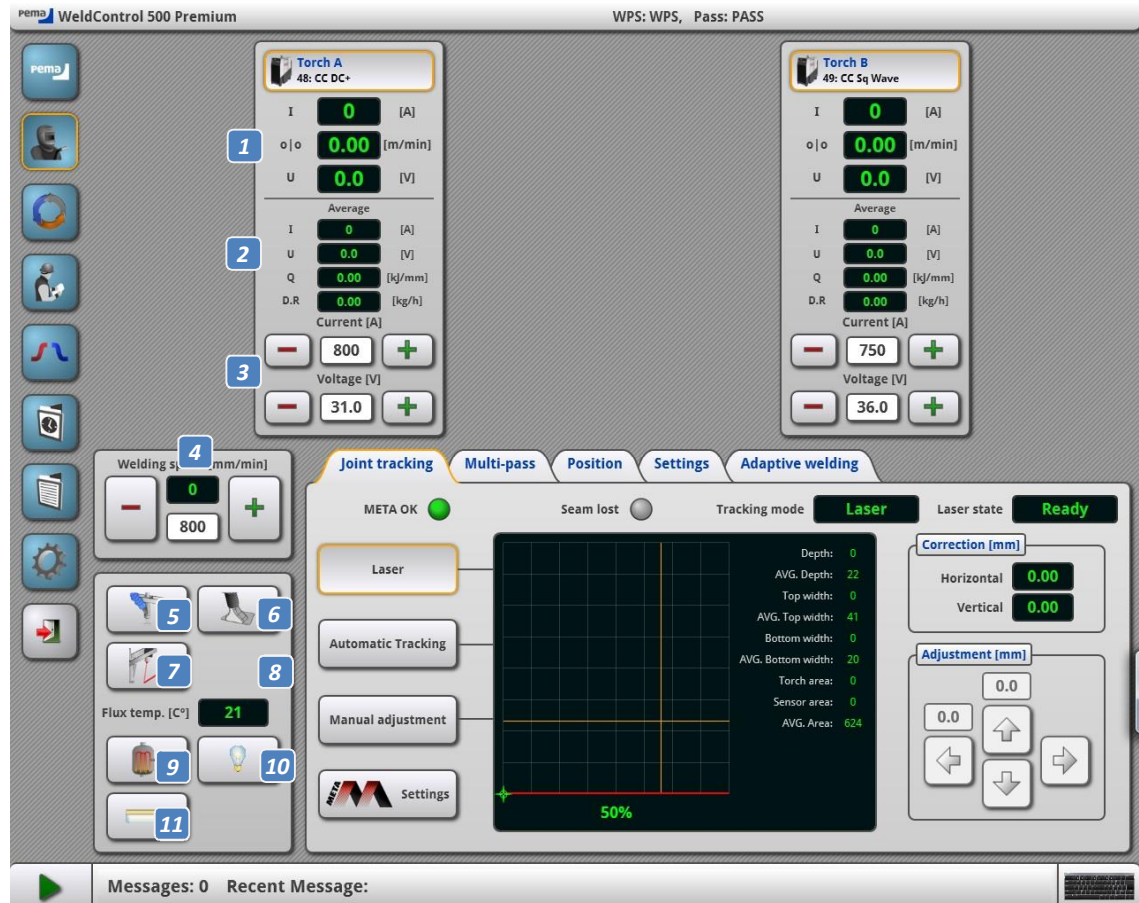


Figure 15 Operator page

1. Actual welding data feedback: current (A), wire feed (m/min) and voltage (V)
2. Production data averages: current (A), voltage (V), heat input (kJ/m) and deposit rate (kg/h)
3. Current and voltage selections and adjustment buttons
4. Actual welding speed and welding speed selection
5. Flux dropping manually on/off
6. Flux suction manually on/off
7. Manual welding laser on/off

8. Flux tank pressure on/off
9. Flux heating on/off
10. Work light on/off
11. Machine lights on/off

6.2.3.1 Operator page; Joint tracking tab

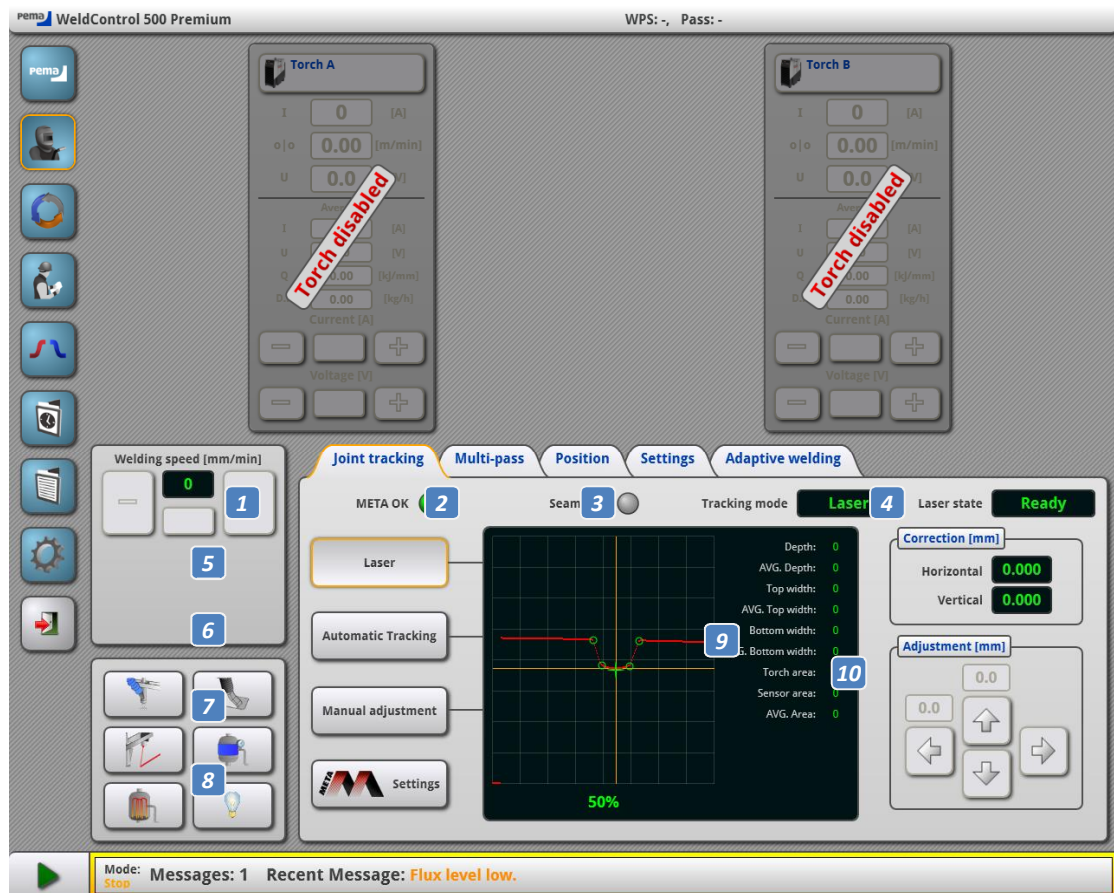


Figure 16: Operator page, joint tracking tab

1. META OK indicator is green: META is ready and communication with META software is OK.
2. Seam lost indicator is red: Automatic tracking is ON and META cannot detect the joint anymore.
3. Currently active tracking mode
4. Laser states
 - a. Ready: Sensor is ready to be used for tracking.

- b. Search: Tracking is turned ON and sensor is searching correct position for wires.
 - c. Tracking: Tracking is turned ON, correct wire positions have been found and META sensor is ready for welding.
 - d. FAULT. There is an error with the communication between META software and META sensor.
- 5. Laser on/off
 - 6. Tracking on/off
 - 7. 'Manual horizontal adjustment' button switches the current tracking mode to 'Height'. It means only vertical changes are tracked – horizontal changes can be made manually.
 - 8. Open META settings page
 - 9. Measured seam data.
 - 10. Seam tracking manual adjustment

6.2.3.2 Operator page: META settings

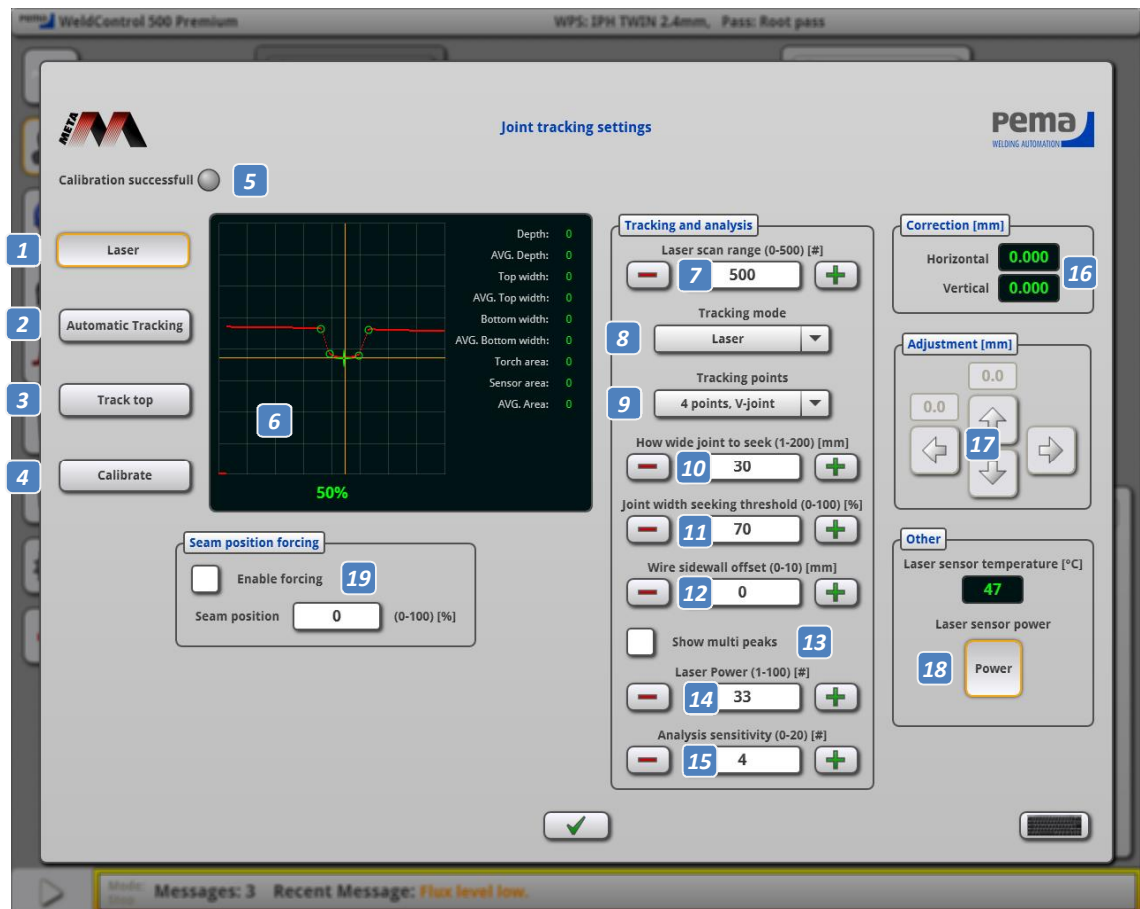


Figure 17: Operator page, META settings

1. Laser ON/OFF.
2. Automatic tracking ON/OFF. When automatic tracking is turned ON, recording of a new track begins. When automatic tracking is turned OFF, the recorded track is saved.
3. Track top means that tracking point is moved from joint bottom to work piece surface level.
4. Calibrate wire position to META sensor. Make sure before pressing that:
 - a. Tracking points are found and stable.
 - b. Wire is in a center of the joint.
 - c. Wire stick out is OK.
5. Calibration successful indicator blinks green when calibration is in process and is set to green when calibration is successful.
6. Laser scan picture:
 - a. Orange cross: calibration point.

- b. Green cross: tracking point.
 - c. Green / purple circles: threshold points. They are green when tracking mode is "Laser" and they are purple when tracking mode is "Replay".
- 7. Laser scan range determines how wide the laser scan area is.
- 8. There are three tracking modes:
 - a. Laser. Joint tracking is based on laser scan.
 - b. Replay. Joint tracking is based on the data that was recorded when "Laser" mode was used last time. Vertical changes are tracked. This mode is useful, when joint has nearly become undetectable. This mode needs to be turned on before joint is undetectable!
 - c. Height. Only vertical changes are tracked – horizontal changes can be made manually.
- 9. Determines how many tracking points are used and what type of the joint META sees.
- 10. How wide joint META should be looking for (top width).
- 11. How big changes in a joint top width META should tolerate when trying to seek the joint.
- 12. Distance between the wire center point and the wall. This parameter is effective only when using four tracking points. Notice: this may also affect to the % positions specified in a WPS!
- 13. Show multi peaks enabling / disabling
- 14. Adjust intensity of laser
- 15. Sensitivity value; too high value for sensitivity affects stability of tracking and how META sees the seam.
- 16. Real time feedback about corrections META is asking the cross-slide to make.
- 17. Adjustment buttons can be used to trim the wire position during the tracking. Adjustment values set with these buttons are effective only during the time when automatic tracking is on. Values are reset when automatic tracking is taken OFF.
- 18. Laser sensor on / off
- 19. Seam position forcing can be used to override the corresponding values loaded from the WPS currently in use.

6.2.3.3 Operator page: multi-pass tab

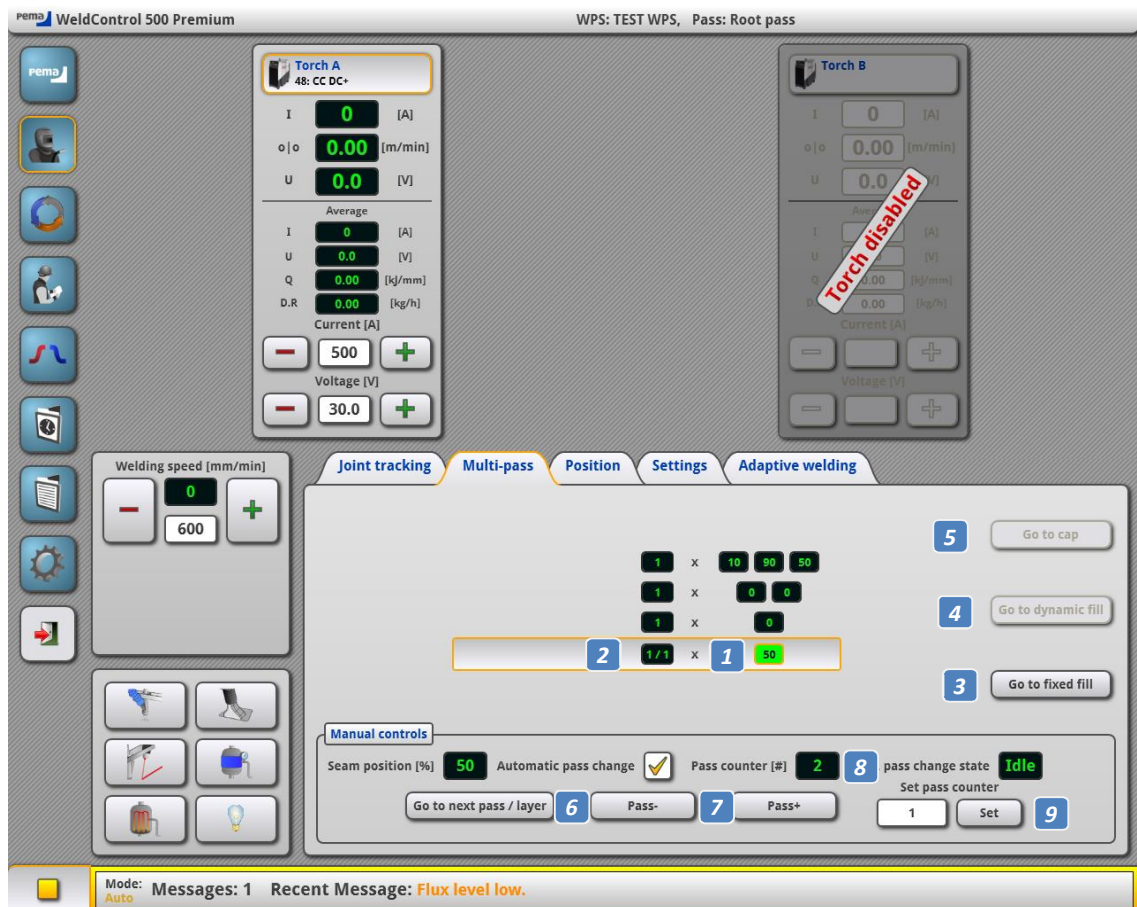


Figure 18: Operator page, multipass tab

1. Multipass state
2. Times to do layer counter
3. Go to fixed fill. Sets active pass to first pass of the fixed fill layers.
4. Go to dynamic fill. Sets active pass to the first pass of the dynamic fill layers.
5. Go to cap. Sets active pass to the first pass of the cap layers.
6. Passes can be cycled onwards with “go to next pass / layer” button
7. “Pass-” and “Pass+” buttons cycle only passes in a current layer
8. Pass counter for data collection
9. Set pass counter

6.2.3.4 Operator page: position tab

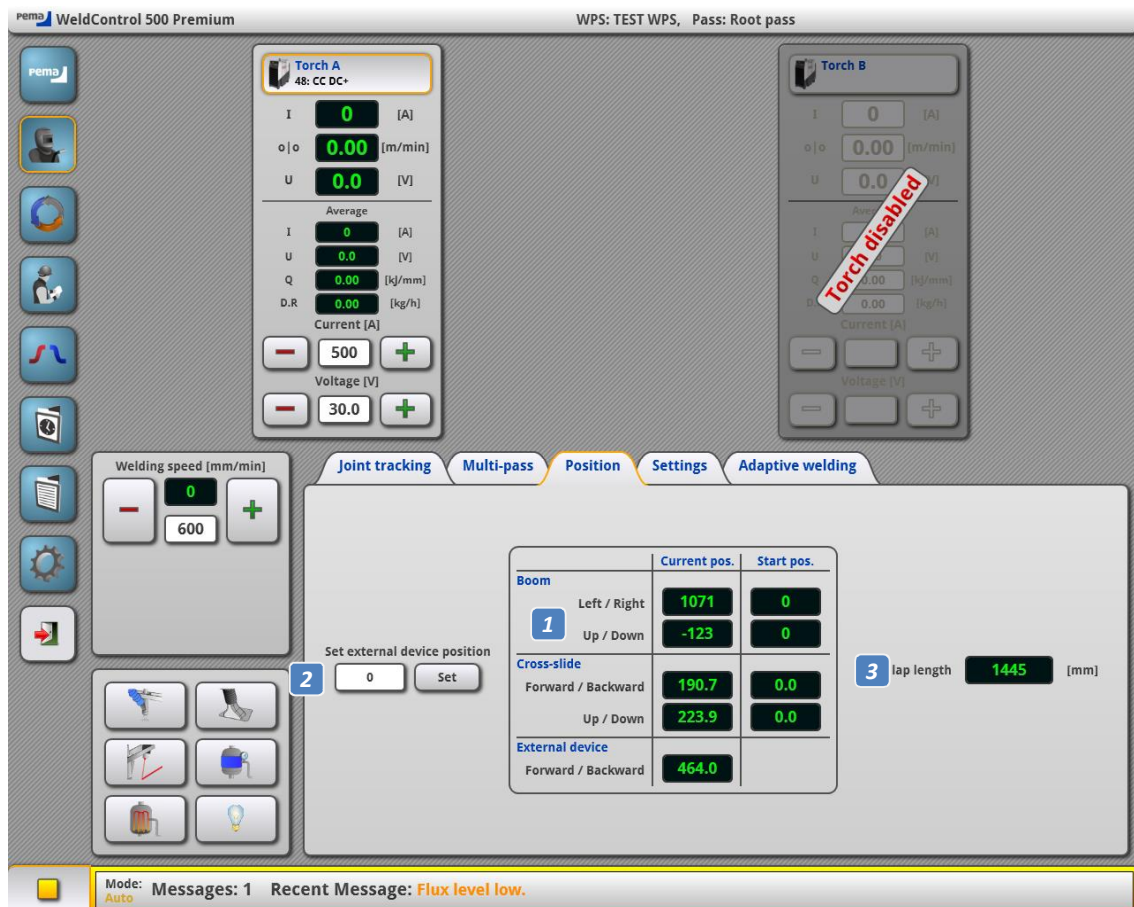


Figure 19: Operator page, positions tab

1. Current axis positions
2. External axis position preset and preset position selection
3. Currently configured external axis welding lap length (Full rotation + overlap distance)

6.2.3.5 Operator page: settings tab

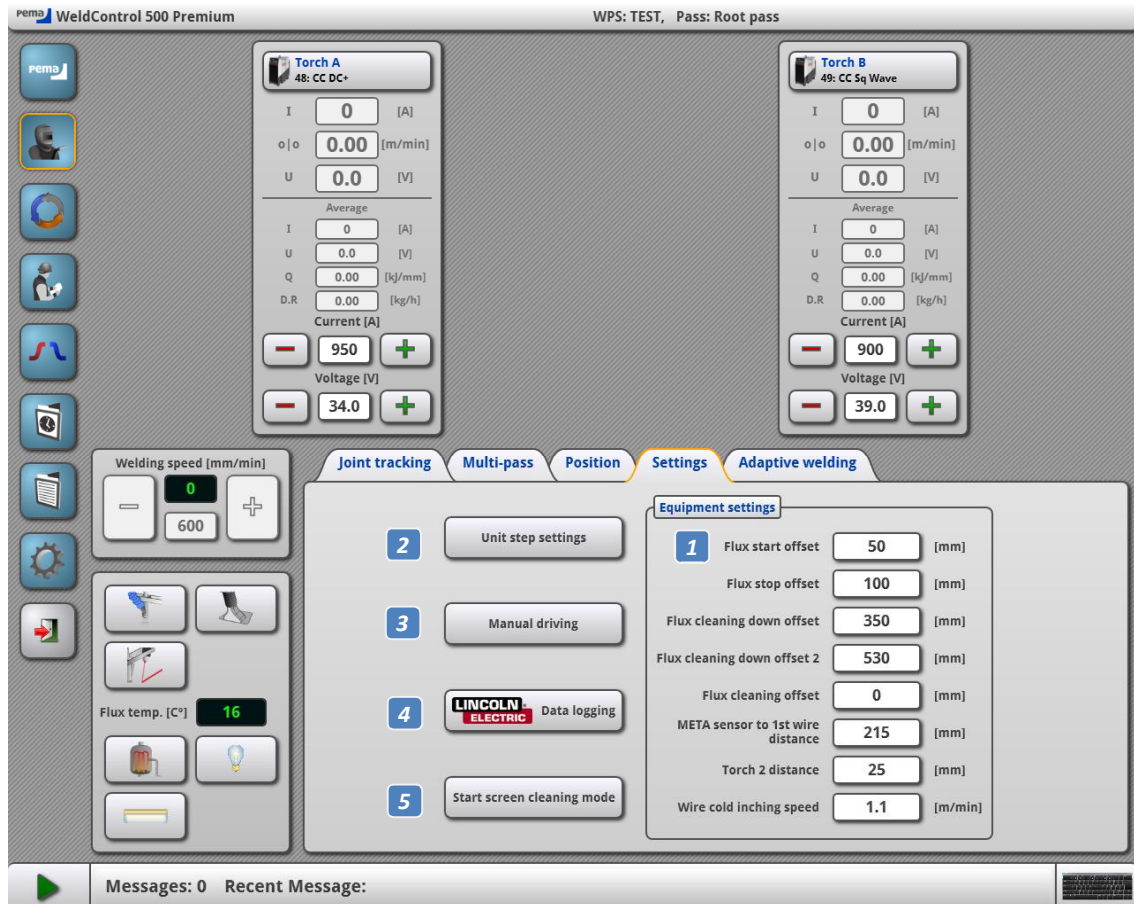


Figure 20: Operator page, settings tab

1. Equipment settings

- Flux start offset: Flux dropping starts this distance before welding start position
- Flux stop offset: Flux dropping stops this distance before welding stop position
- Flux cleaning down offset: Distance of flux cleaning nozzle from welding torches. Configures the position where flux cleaning moves down when welding starts.
- Flux cleaning down offset 2: Same as above but for nozzle number 2
- Flux cleaning offset: Length of flux cleaning movement after welding.
- META sensor to 1st wire distance: Distance from the META laser tracking sensor laser line to first torch. Essential for correct seam tracking and correct welding start position.
- Torch 2 distance: Distance from torch 1 to torch 2. Configures welding start and stop positions for torch 2.
- Wire cold inching speed

2. Unit step settings: Set how much + and – buttons alter values

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Code-Revision: D23399-0

Date: 8.1.2015

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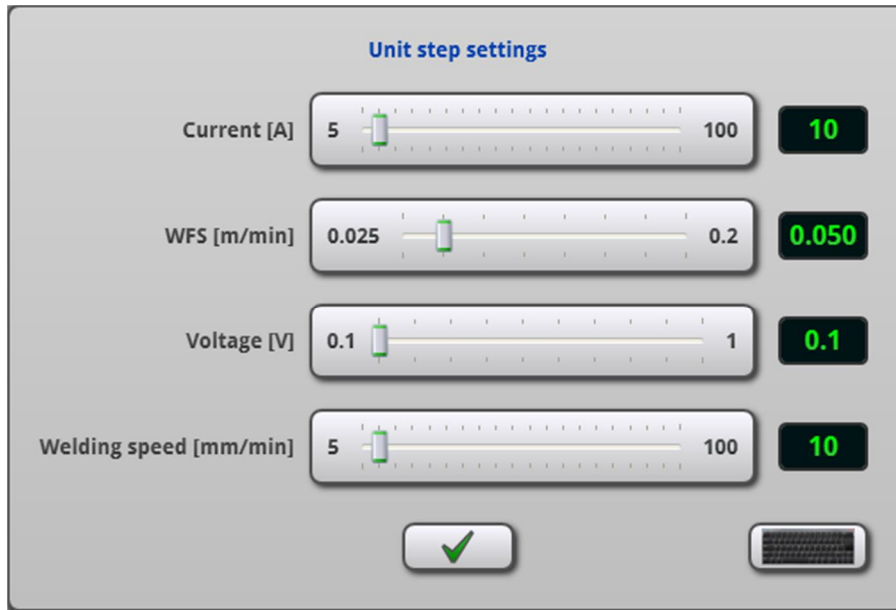


Figure 21: Unit step settings

3. Manual Driving: Control movements from the touch screen.
4. Open Lincoln command center
5. Start screen cleaning mode: Disables touch screen for a short time.

6.2.4 Work cycle page

Work cycle editor is a tool for creating flexible custom work cycles without the need to hard code the functionality into program. Right clicking the task list brings up action menu and left clicking a task in the task list opens the task parameters on the right side of the screen.

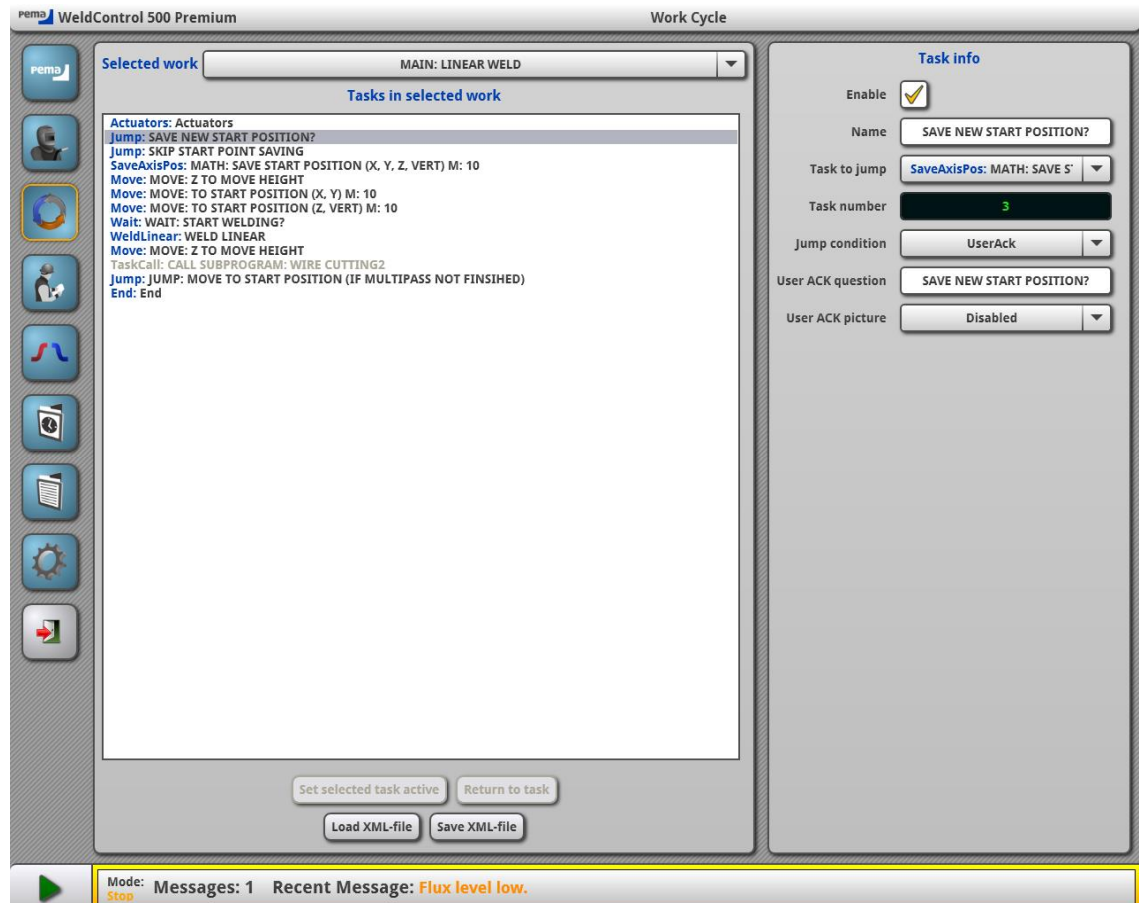


Figure 22: Work cycle page, editor view

In play mode the work cycle page shows the current state of the work cycle.

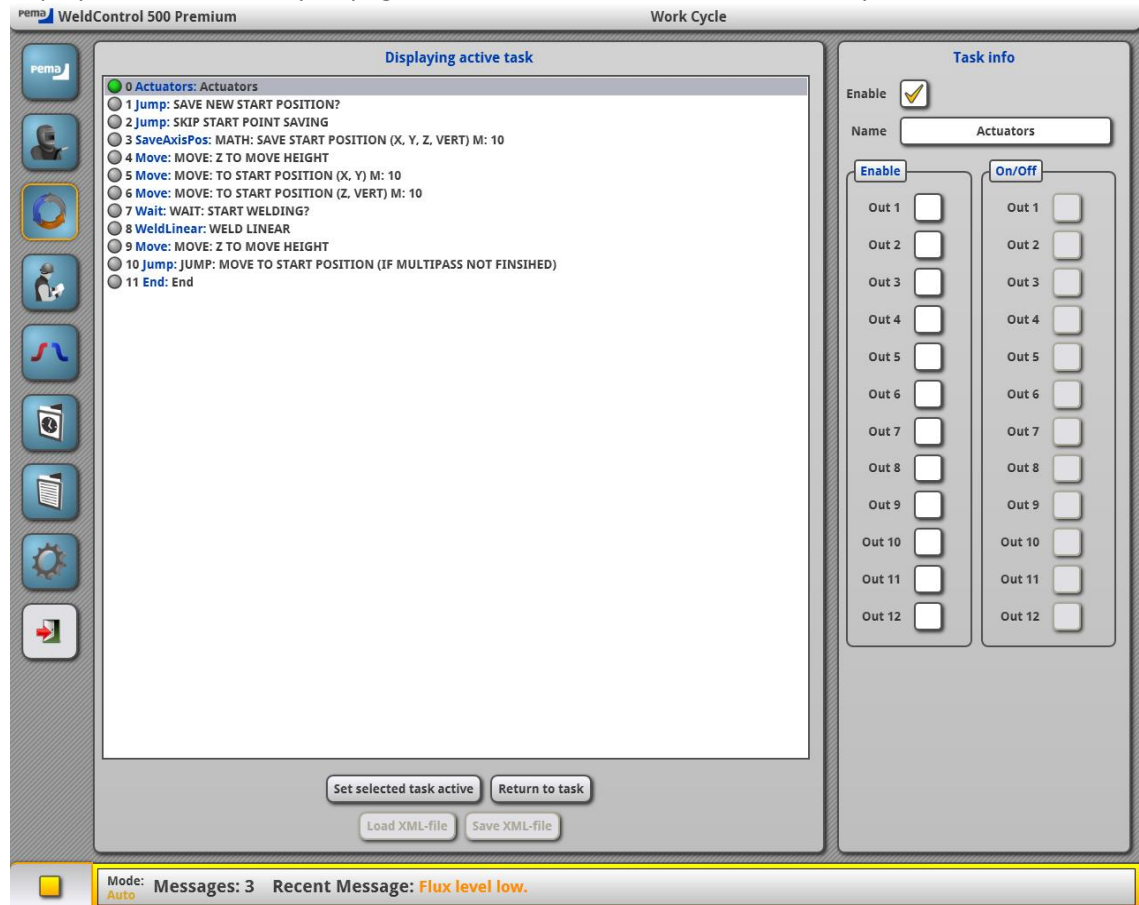


Figure 23: Work cycle page, status view

6.2.5 WPS editor

WPS editor is a tool for creating a complete welding parameter specification for a seam type. Each WPS contains:

- Welding parameter sets
 - Welding parameters
 - Movement settings
 - Phase settings
- Multipass table
 - Layer settings
 - Tracking mode settings for layers
 - Parameter set selections for layers
- Adaptive welding settings (option)

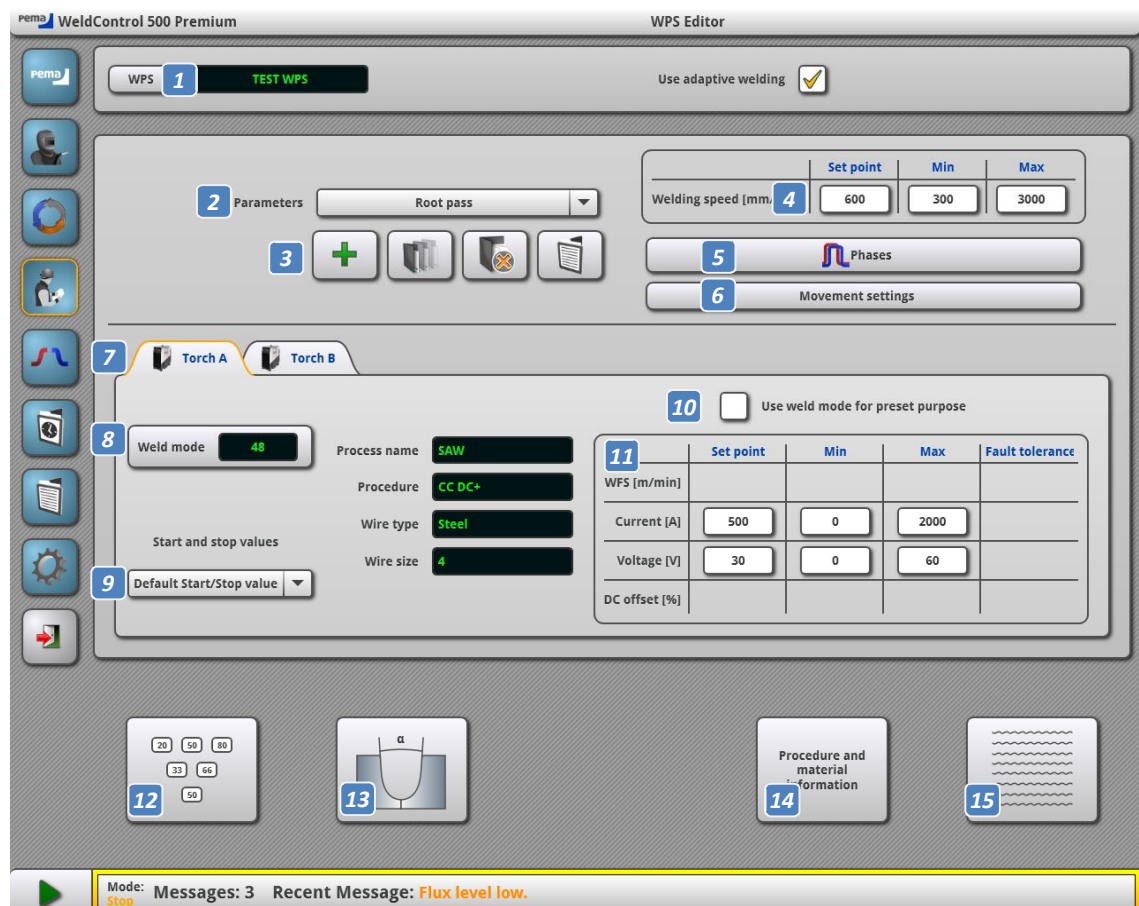


Figure 24: WPS editor

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Date: 8.1.2015

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1. WPS selection
2. Parameter set selection
3. Add, copy, delete and change name of parameter sets
4. Welding speed and limits
5. Torch phase and balance settings
6. Movement settings
7. Torch selection
8. Weld mode selection
9. Welding start and stop values selection
10. Use preset welding mode. Preloads welding mode to be used next in circumferential welding. Disables welding with this torch.
11. Fields for wire feed speed, current, voltage, DC-offset and limits
12. Multipass settings
13. Adaptive welding settings
14. Procedure and material information
15. WPS overview



Figure 25: WPS Selection

1. Select WPS
2. Add a new WPS
3. Make a copy of currently selected WPS
4. Delete currently selected WPS
5. Rename currently selected WPS

6.2.5.1 WPS Editor: phase settings

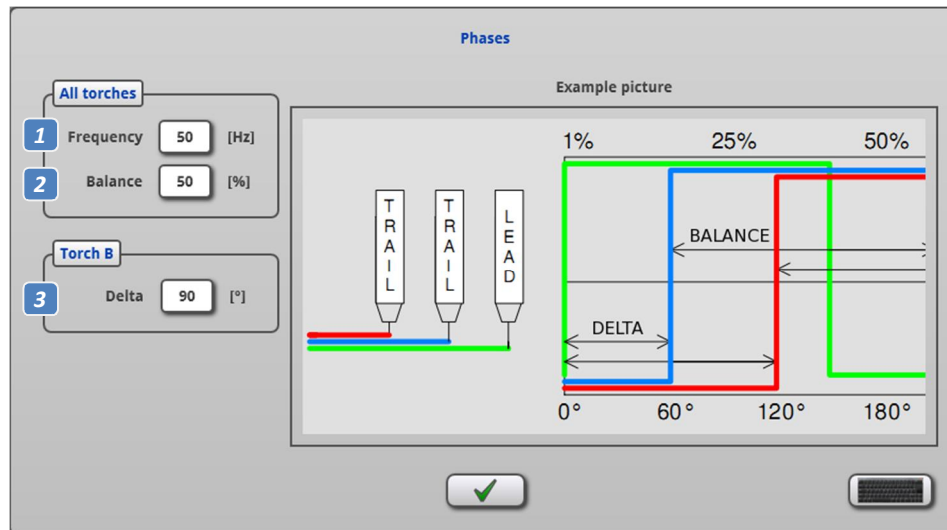


Figure 26: WPS editor, phase settings

1. Frequency
2. Balance. The positive part of square-wave voltage in percentage of the whole period
3. Delta. The phase shift of the other torches in degrees in relation to the first torch.

To minimize the effects of electromagnetism in multiple arc systems, maintaining phase relationship between the arcs (time offset between the arcs) is important. Every arc phase is set according to the leading arc.

The phase settings are sent to the Powerwave power source of the torch 1 that guides the other torches. To accomplish the phase difference the Lincoln Powerwave-equipment has to be set to Lead-Trail –mode with dip-switches and they also has to be connected to each other with synchronization cables.

More information about configuration you can find from Lincoln manual on chapter Phase adjustment for multiple arc systems included in this manual.

Note: The phase settings have effect only in AC-welding.

6.2.5.2 WPS Editor: movement settings

Movement settings have a selection for end ramp and 'movement waits for arc'.

- **End ramp:** End ramp is a feature that can be used to reduce the crater in the end of the weld. It reduces the welding speed linearly from normal welding speed to the final speed in a given distance at the end of the weld.
- **Movement waits for arc:** When enabled the welding movement is stopped when welding trigger is activated and continues when welding arc is detected. Used when precise welding start point is required.

Figure 27: WPS editor, movement settings

1. Enable end ramp in this parameter set
2. Ramp length: Defines when the slowdown ramp starts, measured from the last torch.
3. Ramp end speed factor: Defines the final speed at the end of the ramp. (0.5 = 50% of the welding speed)
4. Ramp offset: Ramp shift. If zero, the ramp reaches final speed when last torch reaches weld end. (negative value makes ramp start and reach final speed earlier).
5. Enable movement waits for arc –feature

6.2.5.3 WPS Editor: multipass editor



Figure 28: WPS editor, multipass editor

1. Layer display
2. Adds layer on top of the currently selected layer
3. Adds layer below the currently selected layer
4. Delete the currently selected layer
5. Increases the amount of passes in the currently selected layer
6. Decreases the amount of passes in the currently selected layer
7. META Tracking mode selection. Tracking mode must be changed to replay mode a bit before the seam is filled to the point when seam tracking no longer recognizes the seam.
8. Joint type. Root modes must be used when the seam bottom is a sharp corner. Normal modes can be used if seam already has something welded on the bottom.
9. Welding parameter set used in the selected layer.

10. Layer can be set to repeat multiple times to reduce the visual size of the multipass table.
Note: Adaptive welding with seam area reference will not work correctly if same layer is repeated.
11. The torch position in reference to the seam bottom width. [0—100%] 100% is to the right bottom edge when looking from the tracking sensor towards the welding torches.
12. Start offset. Adjusts welding start position from the welding start position. Used to cascade weld starts during multipass welding. (Positive direction is the welding direction.)
13. Start offset. Adjusts welding stop position from the welding end position. Used to cascade weld ends during multipass welding. (Positive direction is the welding direction.)
14. Reference area for the pass for adaptive welding. If seam area reference is selected in adaptive welding settings sensor calculates the seam area and compares the value to this setting and adjusts the initial compensation accordingly. Note: In replay mode the area must be set to equal to the area of the last laser tracking pass.

META laser seam tracking sensor has three modes of operation: Laser tracking, replay and height mode.

- **Laser:** In laser tracking mode the sensor scans the seam and attempts to detect the configured seam type. Seams geometrical data is recorded during laser tracking and is stored for later use in replay mode.
- **Replay:** Eventually the seam will start to fill up to the point where the laser tracking mode cannot detect the seam anymore. A transition to replay mode should be done a bit before this happens to ensure continuous tracking data of the seam. In replay mode the sensor fits the measured height map of the seam to the seam position in the memory and calculates new positions for the seam bottom corner points. Sensor does not record any new data to the memory in replay mode so the seam data (i.e. top width and seam area) of the previous laser tracking is displayed.
- **Height:** In height mode the sensor adjusts only the vertical position of the torch. Horizontal position is controlled manually by the operator.

In Figure 29: Example of laser tracking and replay mode settings is illustrated an example of laser tracking and replay mode settings. The first two layers utilize laser tracking and the last two are set to replay mode.

1. Laser tracking
2. Replay

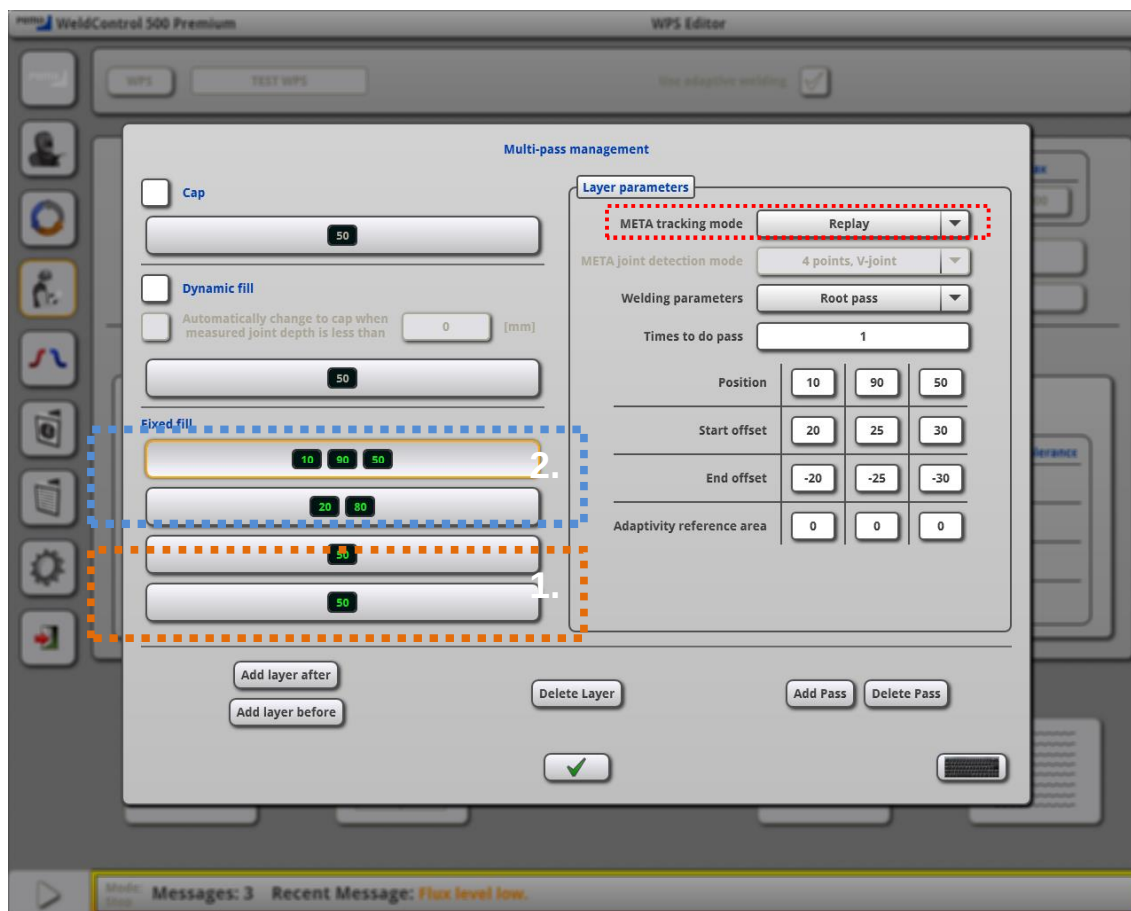


Figure 29: Example of laser tracking and replay mode settings

6.2.5.4 WPS Editor: multipass dynamic fill and cap layers

Adaptive filling is a multipass welding feature that repeats layers until defined seam bottom width is reached. It can change to different adaptive filling layers on defined seam bottom width thresholds. Adaptive filling is meant to be used with large seams to simplify multipass table creation in cases where fixed multipass table would not be feasible. Fixed cap layers can be used after the adaptive filling reaches a defined seam depth to produce the top of the weld.



Figure 30: WPS editor, multipass editor with adaptive fill and cap enabled

1. **Fixed fill:** If the number of passes needed for filling the joint stays always the same, this is a good option (usually with small joints). Layers under "fixed fill" are done number of times specified in the respective column.
2. **Dynamic fill:** Layers under "dynamic fill" are done as many times as next layers "joint width threshold" is met. If "Automatically change to cap" –function is allowed welding mode transfers mode Cap automatically when surface layer need finishing. If this function is used set value of biggest allowed joint depth between surface of pass and surface of work piece. This is a good option, if count of passes varies (usually with large joints).
3. **Cap:** Cap is another "fixed fill" system. The difference to "fixed fill" is that "cap" comes after "dynamic fill". So if some fixed count of layers is needed after dynamic fill, those layers can be specified here.

6.2.5.5 WPS Editor: WPS info

Procedure and material information

Welding process

Welding process name

Welding position

Groove preparation

Groove cleaning

Jigging of the work piece

Tacking

Backing

Back group

Pre heat temp.

Interpass temp.

Continuous temp.

Post heat temp.

Parent metals

ID	Parent metal type	Classification 1	Classification 2	Thickness	Outside diameter

Filler metals

Classification

Brand name

Wire diameter

Top flux

Backing flux

Figure 31: WPS editor, WPS info

Procedure and material information can be seen and edited by choosing WPS while being in WPS editor page and pressing Procedure and material information button.

6.2.5.6 WPS Editor: Parameters overview

Parameters overview										
Pass	Welding speed	Torch	Mode	Current	Voltage	WFS	DC offset	Frequency	Delta	Balance
Root pass	600	Torch A	48: CC DC+	500	30			50		50
		Torch B							90	
Filling	800	Torch A	48: CC DC+	600	30			50		50
		Torch B	49: CC Sq Wave	750	31		0		90	
Cap	600	Torch A	48: CC DC+	500	32			50		50
		Torch B							90	

Figure 32: WPS editor, parameters overview

Parameters overview window displays all the welding parameter sets currently configured in the currently selected WPS in the editor.

6.2.6 Start/Stop parameter editor

It is possible to create different start/stop parameter sets to be assigned for welding parameter sets in the WPS editor (see page: 43 WPS editor).



Figure 33: Start/Stop parameter editor

Start/Stop parameters configure how the welding process starts and stops. Each parameter set contains parameters for CV (left) and CC (right) modes.

1. Open parameter set selection
2. Strike speed determines the wire feeding speed when welding is triggered but welding arc is not yet present.
3. Start parameters define certain parameters that the power source holds for a set amount of time right after the arc is detected.
4. Upslope defines the time the power source takes to transfer linearly from start parameters to the set welding parameters.
5. Crater filling defines the time and parameters for crater filling after the welding trigger is turned off.

Author: TLe

Code-Revision: D23399-0

Date: 8.1.2015

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6. Burnback defines the time the power source holds a voltage in the torch after it stops the wirefeeding to prevent wire from sticking to the work piece.
7. Restrike attempts to reignite welding arc if it drops in the middle of welding before giving an arc error. Settings include wire feeding speed and time.



Figure 34: Start/Stop editor, parameter set selection

1. Select welding start and stop parameters set
2. Add a new welding start and stop parameter set
3. Make a copy of currently selected set
4. Delete currently selected set
5. Change a name of currently selected set

6.2.7 Data collection

Data collection records data from each weld under a file designated by workpiece name and serial number.

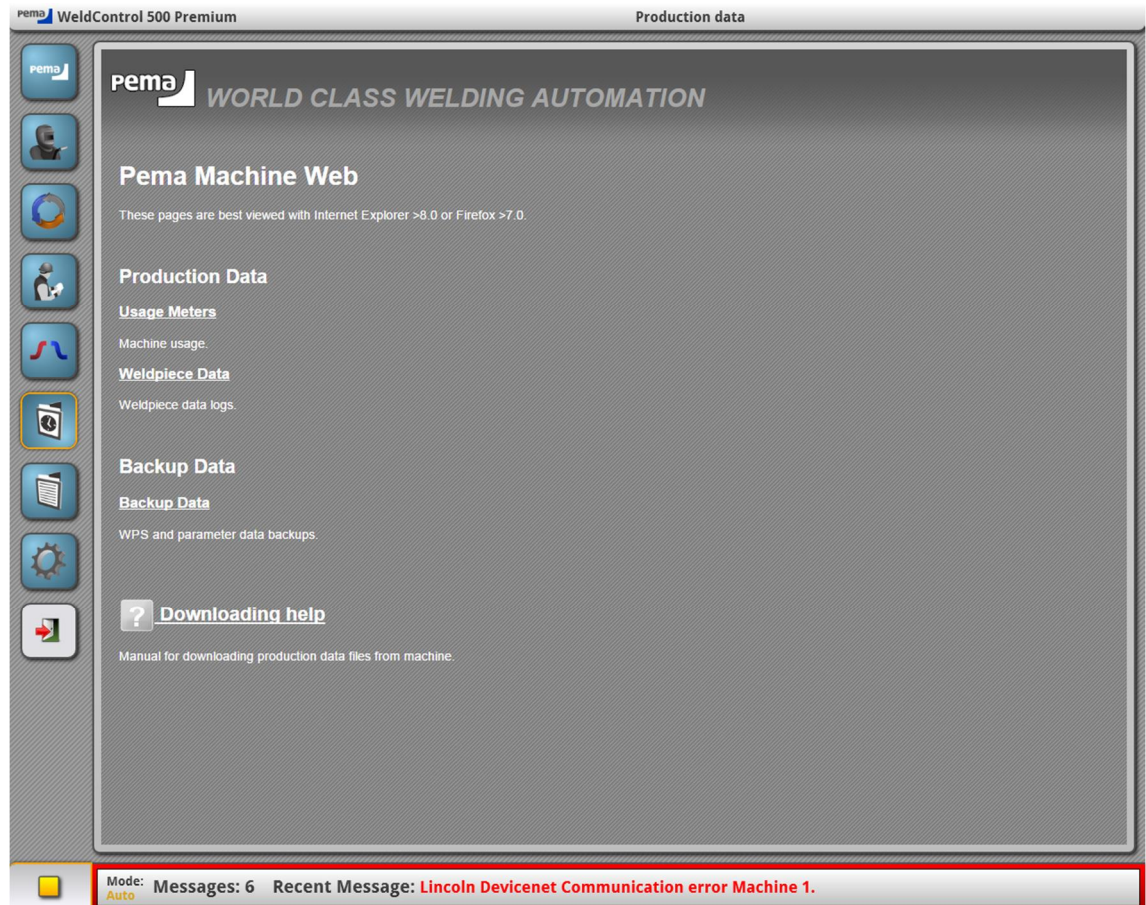


Figure 35: Data collection page

6.2.8 System messages

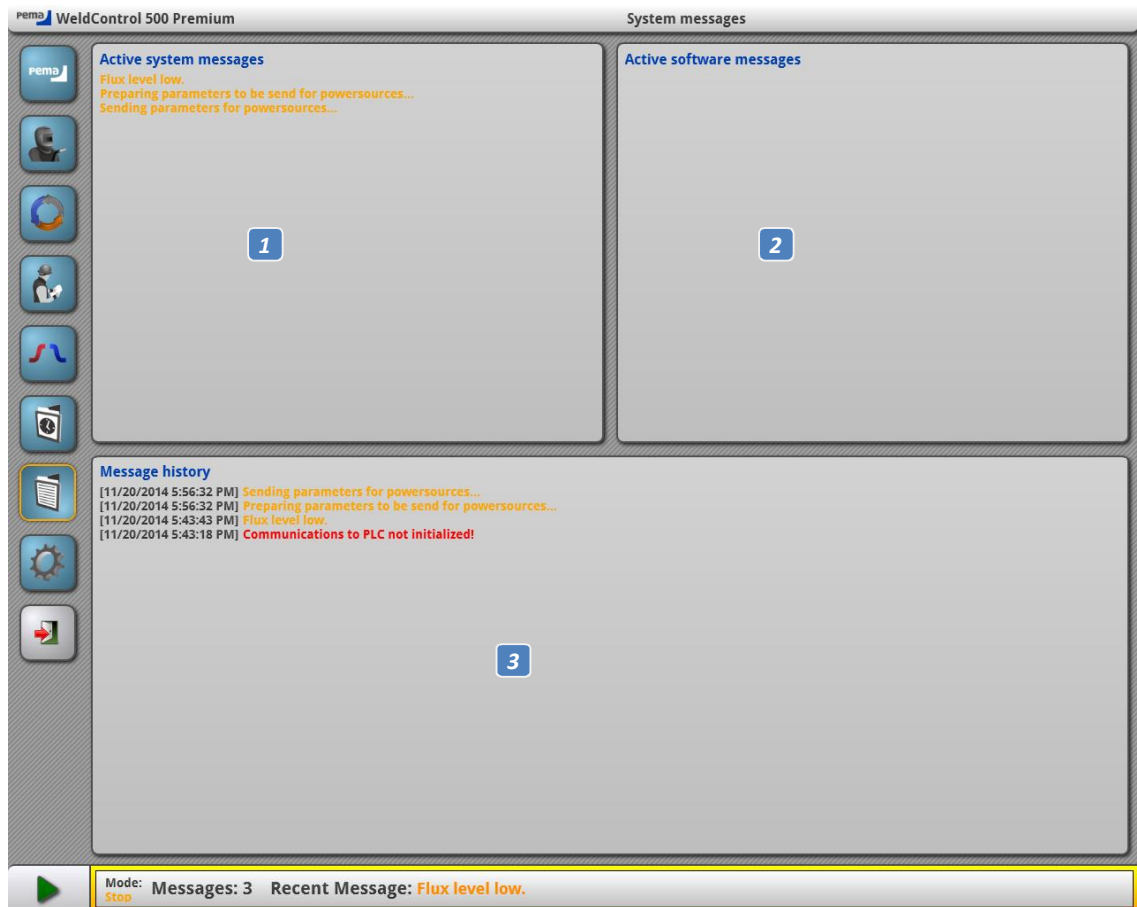


Figure 36: System messages

1. Active system messages from the machine control system
2. Messages from WeldControl 500 software
3. All messages are stored in a message history

6.2.9 Settings

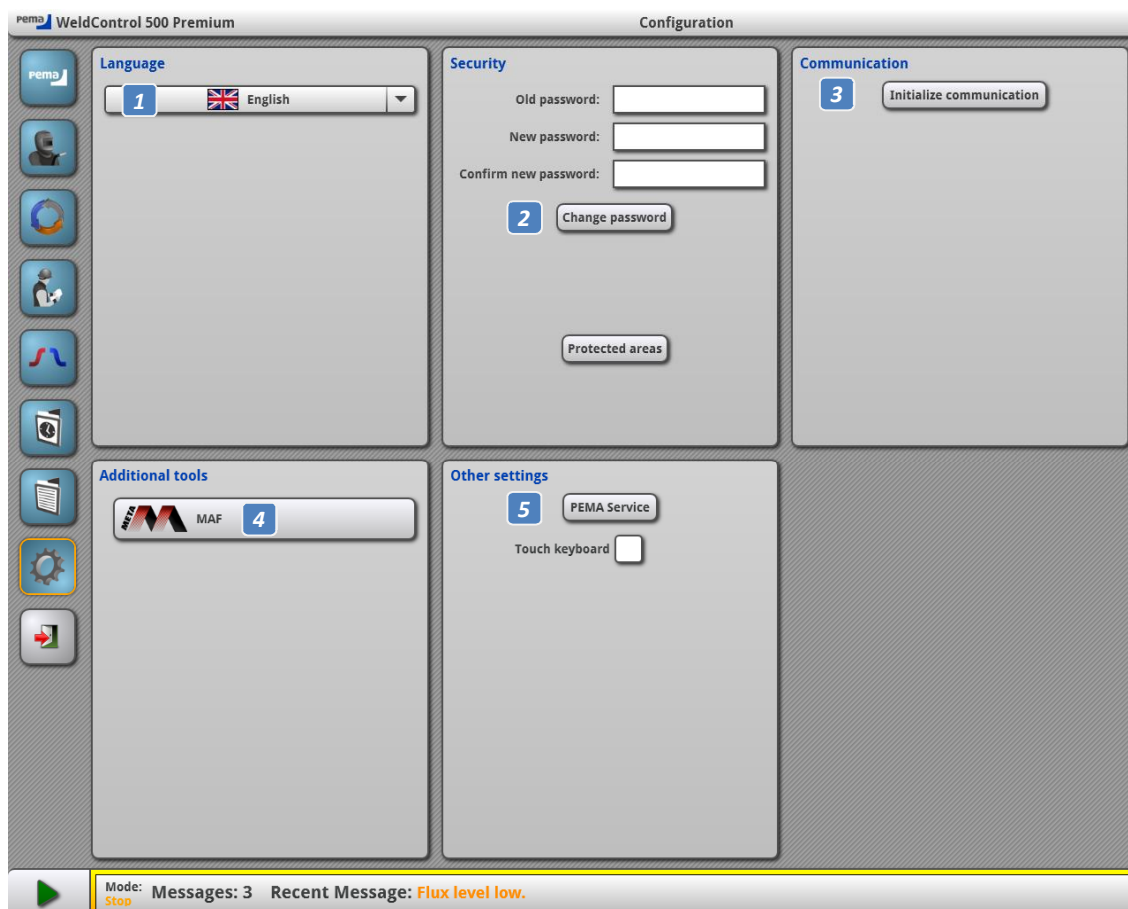


Figure 37: Settings

1. Change language
2. Change password
3. Reset communication between user interface and PLC
4. Shortcut to the joint tracking control window
5. Pema service settings

6.3 Welding

The following list is a general list of steps to perform before welding. See page: 65, Work cycle welding.

1. Generate WPS for welding (see page: 59, WPS creation)
2. Check the general equipment settings (see page 39: Operator page: settings tab).
3. Select welding mode and relevant selections (work cycle, WPS selection etc. see page 30: Start page)
4. Load selections by engaging the play mode (see page 29: Sidebar and general UI functions)
5. Calibrate META seam tracking sensor if necessary (see page 62: Seam tracking sensor calibration)
6. Move welding torches to start position
7. Check welding parameters and multipass table (see page 37: Operator page: multi-pass tab)
8. Check torch activation (see page 32: Operator page)
9. Start the welding process

6.3.1 WPS creation

6.3.1.1 Define welding parameter sets

Parameter sets are collections of welding settings. You can assign different parameter sets to welding layers in the multipass editor page.

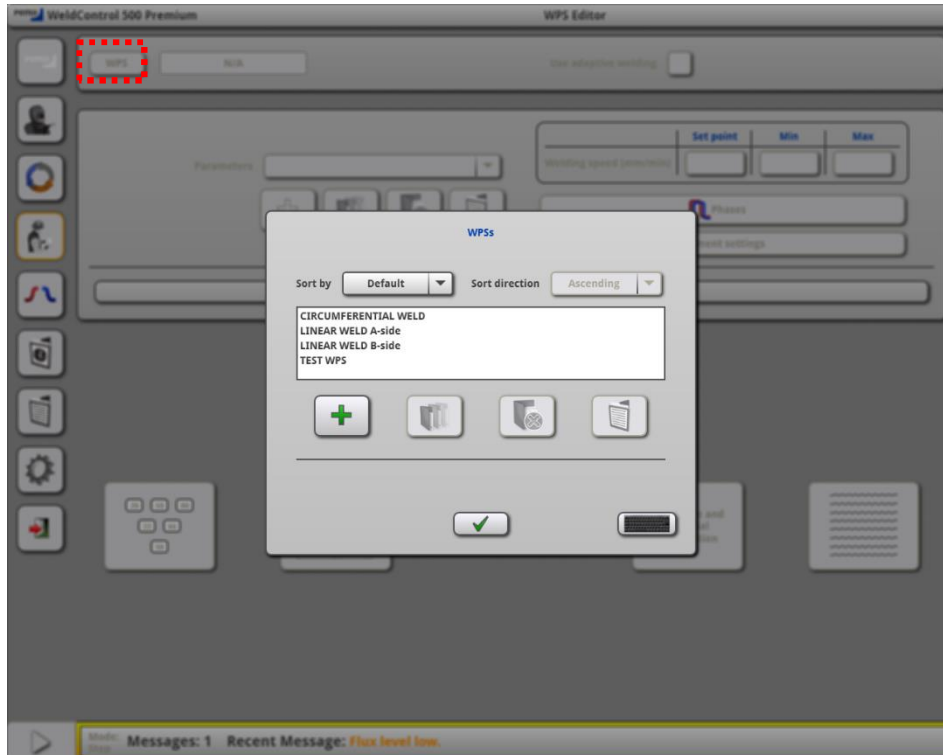


Figure 38: WPS editor, WPS selection

Click WPS selection and create a new WPS and name it. Select the created WPS and press ok.

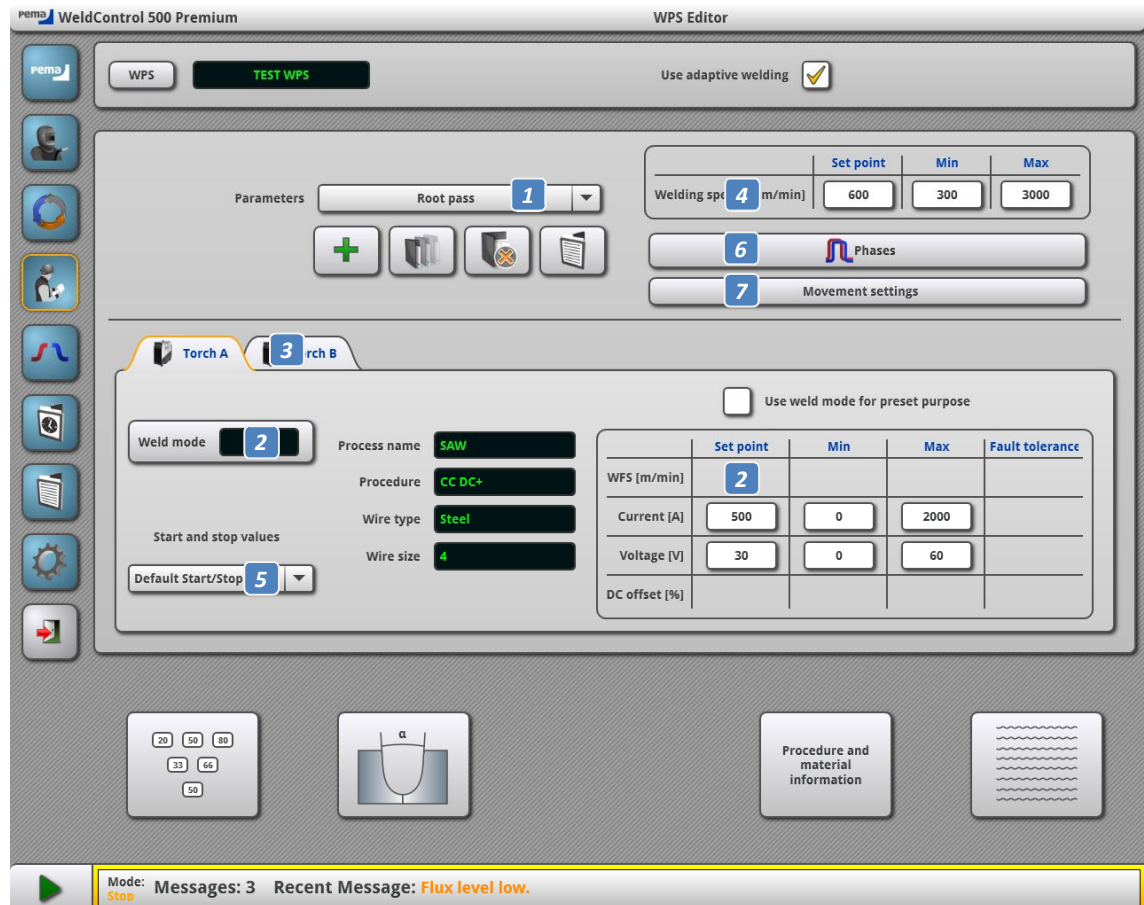


Figure 39: WPS Editor, welding parameter set

1. New WPS has one parameter set named 'Root pass' by default. You can rename it or use it as it is. In this guide we decide to leave the name 'Root pass'.
2. Select welding mode for torch A in root pass and configure welding parameters (Current, voltage etc.)
3. Select torch B and select a welding mode and configure welding parameters (Or select disabled as welding mode to weld only with torch A). If you are configuring a continuous circumferential welding, you need to preload a welding mode by selecting 'use weld mode for preset purpose' in a previous welding parameter set to be able to start the torch later (**Changing welding mode when welding is active is not possible**).
4. Set welding speed. You can also set minimum and maximum limits for welding speed adjustment.
5. Select start/stop parameter set for root pass (Default selection is 'Default Start/Stop values')
6. Adjust phase settings if needed
7. Adjust movement settings if needed (see page 46: WPS Editor: movement settings).

6.3.1.2 Setup multipass table

The multipass editor is used to configure layers and passes in multipass welding. You can assign welding parameter sets created in previous section to layers here.



Figure 40: WPS editor, multipass editor

1. Configure a fixed fill layer (see page 47: WPS Editor: multipass editor).
 - e. Select layer
 - f. Select a welding parameter set for the layer
 - g. Define META seam tracking settings for layer
 - h. Define number of passes in layer
 - i. Set parameters for each pass. (Note: when using area reference in adaptive welding, set all the layers that use replay tracking mode to same adaptivity reference area as the last laser tracking pass.)

2. Create more layers as needed and configure their parameters as in step 1.
3. Enable dynamic fill and cap layers if needed. Create and configure dynamic fill and cap layers. Set the width thresholds for each dynamic fill layer and set the depth threshold for the cap layers. (see page 50: WPS Editor: multipass dynamic fill and cap layers)

6.3.2 Seam tracking sensor calibration

Seam tracking sensor needs to be calibrated when lead torch position or sensor position has changed. Calibration defines torch position horizontally and vertically in relation to the sensor (sensor distance from the torches is defined separately in operator page settings tab). **Recalibration is not needed if sensor and torches have not been moved.**

Calibration procedure:

1. Load WPS by engaging play mode or select appropriate seam type manually from the MAF settings (see page 32: Operator page)
2. Turn seam tracking laser on
3. Move the lead wire to welding position with desired stick out in the middle of the seam bottom (sensor will always calibrate to 50% position). Do not touch the cross-slide after setting the correct place for lead wire. Wire can be inched back if needed.

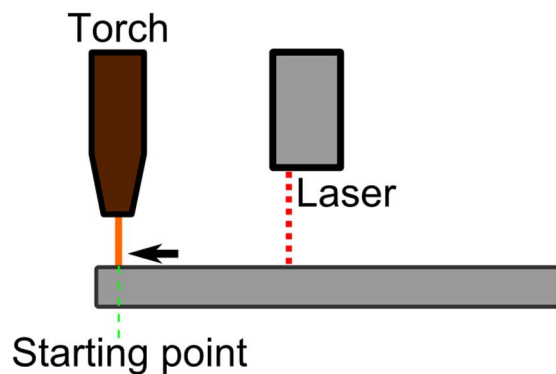


Figure 41: Position torch into correct root pass position.

4. Move the laser line backwards to where the lead torch was, using the welding axis movement. Remember not to move the cross slide.

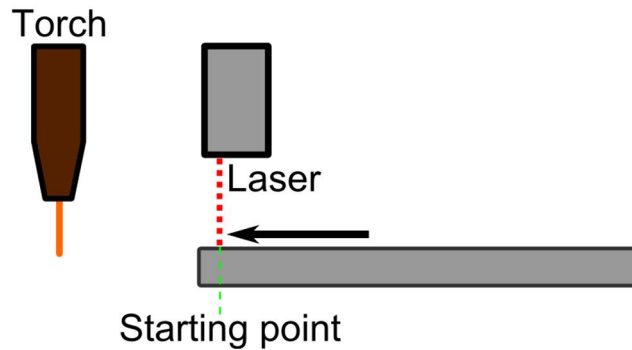


Figure 42 Move the laser starting position without moving the cross-slide

5. Go to MAF settings in operator page (see page 32: Operator page) and press Calibrate. Calibration is successful if the yellow crosshair moves to the green cross and the green 'calibration successful' indicator lights up.

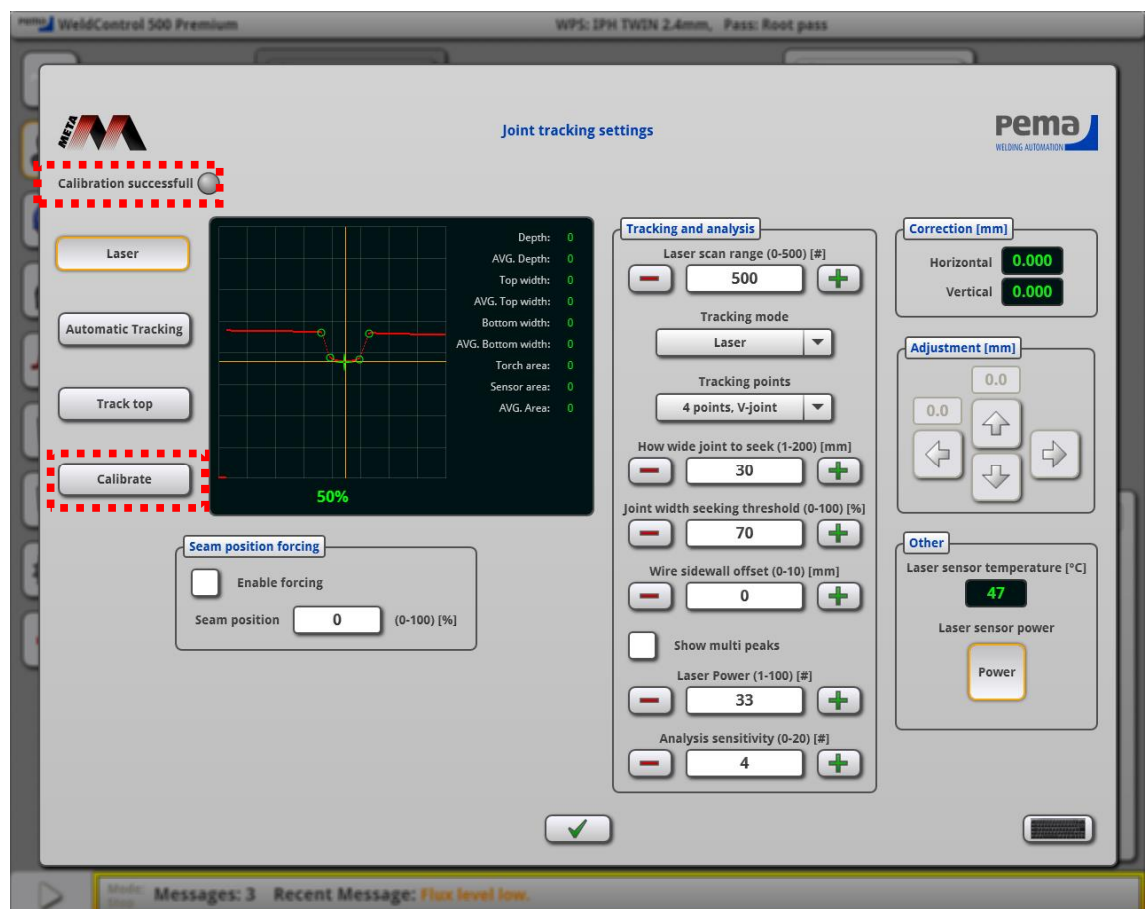


Figure 43: Operator page, MAF settings

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Code-Revision: D23399-0

Date: 8.1.2015

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Note: To achieve accurate tracking it is important to move the laser line to the position where correct torch position was determined before calibration. If calibration is done without moving the laser line, the possible misalignment of welding direction and seam or seam shape variation (seam is different in the laser position than in the torch position) might cause an offset error to tracking.

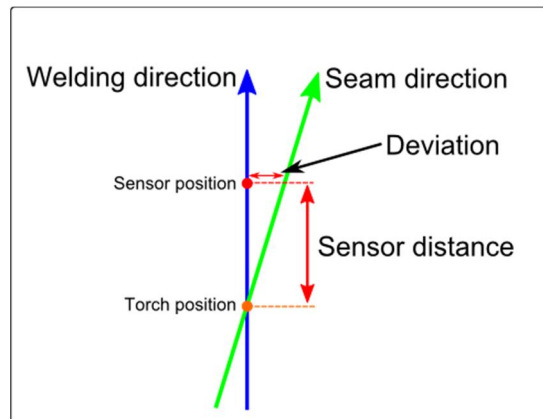


Figure 44: Exaggerated example of deviation error between seam direction and welding axis direction

6.3.3 Work cycle welding

Work cycles enable the possibility to create various automatic work cycles without the need to hardcode them into the program. In work cycle mode the WPS selection and welding length is defined in the work cycle definition or in Pema main page depending on work cycle selection. Work cycle also operates the seam tracking sensor and advances multipass table automatically. See attachment 'Work cycles' for details on specific work cycles.

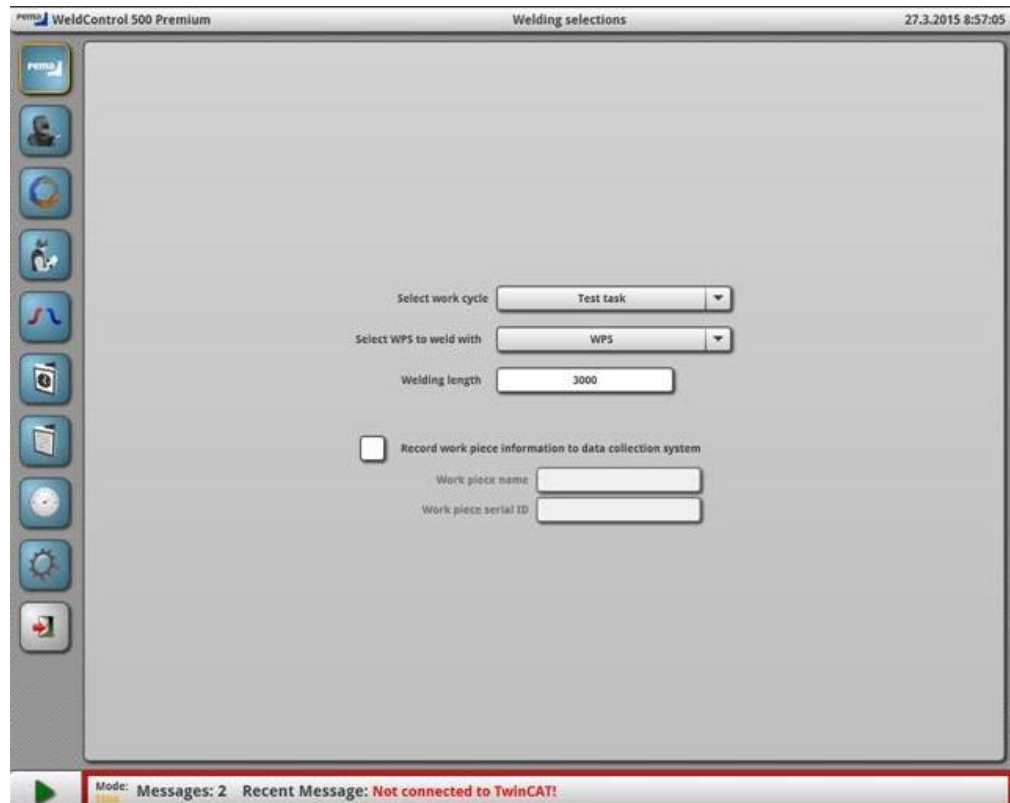


Figure 45: Start page, work cycle welding selection

Typical work cycle welding procedure:

1. Select work cycle
2. Check data collection settings
3. Load selections by engaging the play mode (see page 29: Sidebar and general UI functions)
4. Calibrate META seam tracking sensor if necessary (see page 62: Seam tracking sensor calibration).
5. Move to correct starting position (depends on the used work cycle)
6. Check torch activation (see page 32: Operator page)
7. Start the work cycle

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Code-Revision: D23399-0

Date: 8.1.2015

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6.4 Miscellaneous

6.4.1 Reset

Reset function disengages play mode. WPS selection and multipass table position are not changed unless different WPS is loaded.

6.4.2 WeldControl 500 backup system

Notes:

- With default settings WeldControl 500 stores 10 000 backup files. Backup data older than that is removed automatically to prevent hard disk space from running low.
- If you want to preserve older backup files, please take them from panel with USB-stick.
- Default folder for backup data is "C:\PEMA\WeldControl 500\Backups\".
- "WpsManager.xml" contains WPS-data. "Sequencer.xml" contains data for start and stop values. Other data files contain mainly user interface settings.

Restoring WeldControl 500 backup file:

1. Shutdown WeldControl 500 software.
2. Go to folder "C:\PEMA\WeldControl 500\Data\". Take backups of the files inside this folder (if something goes wrong when restoring backups, you still have backups of the current data files).
3. Go to folder "C:\PEMA\WeldControl 500\Backups\". This is a folder to store backup data. Each backup file inside this folder has a date and time prefix.
4. Copy the desired backup file from folder "C:\PEMA\WeldControl 500\Backups\" to folder "C:\PEMA\WeldControl 500\Data\".
5. Remove the original data file in folder "C:\PEMA\WeldControl 500\Data\". Remove prefix from backup file name so that it matches the data file name.
6. Start WeldControl 500 software.

Restoring WeldControl 500 backup file:

1. Shutdown WeldControl 500 software.
2. Go to folder "C:\PEMA\WeldControl 500\Data\". Take backups of the files inside this folder (if something goes wrong when restoring backups, you still have backups of the current data files).
3. Go to folder "C:\PEMA\WeldControl 500\Backups\". This is a folder to store backup data. Each backup file inside this folder has a date and time prefix.
4. Copy the desired backup file from folder "C:\PEMA\WeldControl 500\Backups\" to folder "C:\PEMA\WeldControl 500\Data\".
5. Remove the original data file in folder "C:\PEMA\WeldControl 500\Data\". Remove prefix from backup file name so that it matches the data file name.
6. Start WeldControl 500 software.

7 MAINTENANCE AND SERVICE INSTRUCTIONS

7.1 Introduction

	! CAUTION ! Read and understand the INSTRUCTION MANUAL before maintaining or servicing the machine!	
• Observe the following safety precautions before servicing or maintaining the equipment. • Read manufacturer's service instructions before servicing electric motors. • Tripped thermal relay or circuit breaker indicate interference, failure or overload. • In order to prevent any further damages eliminate the source of the failure before restarting the machine or before changing any parts. • Warranty does not cover damages caused by faulty, improper unauthorized service, use, storage or handling, overloading or carelessness of equipment.		

	! WARNING ! ELECTRIC SHOCK - can kill	
• Only authorised electrician may service electrical devices. • Follow the service instructions and safety instructions. • Disconnect main power supply before removing any protecting cover. • Disconnect main power before service or maintenance. • Relieve feeding fuses before service or maintenance.		

Author: TLe

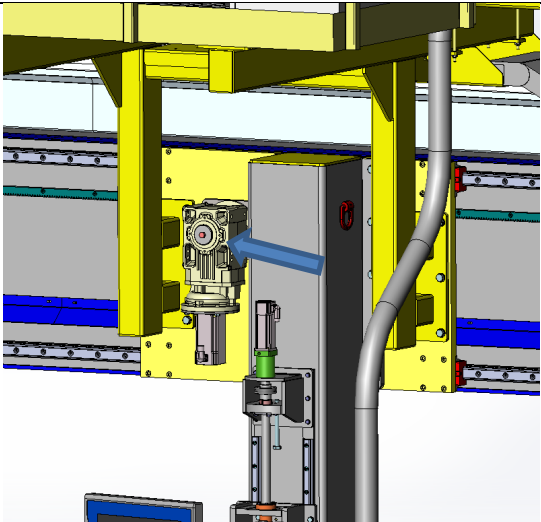
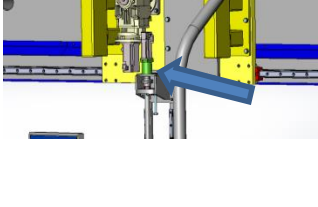
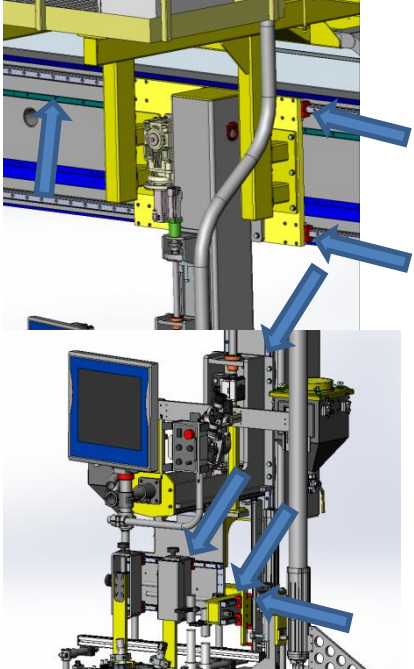
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7.1.1 Lubrication instructions

Gear assembly A302 Gearboxes from A102 to A303 are life lubricated with synthetic oil and do not require periodical oil change.	
Gear MP060 Lubricated for life Lubricant specs can be found on the nameplate.	
Linear guides Lubricant: HIWIN G05 Lithium type soap base Vaseline NLGI2 Period: 3-4 months Rack bar Clean rack bar with pressured air once a month.	

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Code-Revision: D23399-0

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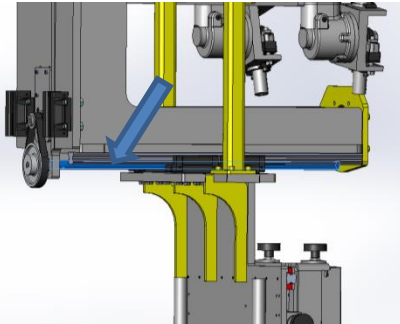
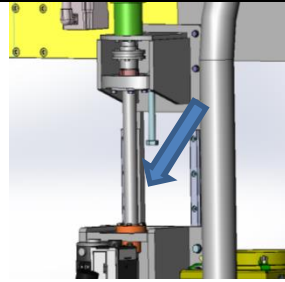
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Ball screw

Lubricant: HIWIN G05 Lithium type soap base Vaseline NLGI2

500 h / 6 month, whichever comes first



* The re-lubrication period will depend on the operating conditions of the machine: speed, load, number of working cycles per day etc. The adjacent table gives recommended values (operating temperatures not exceeding +70° C). At higher temperatures the re-lubrication intervals should be shorter.

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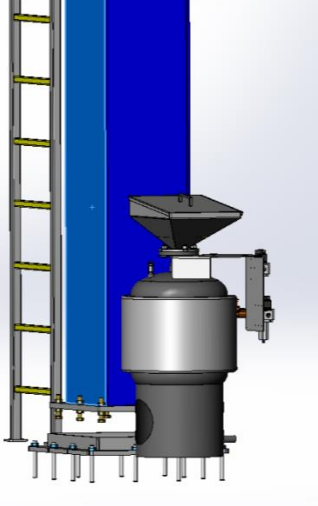
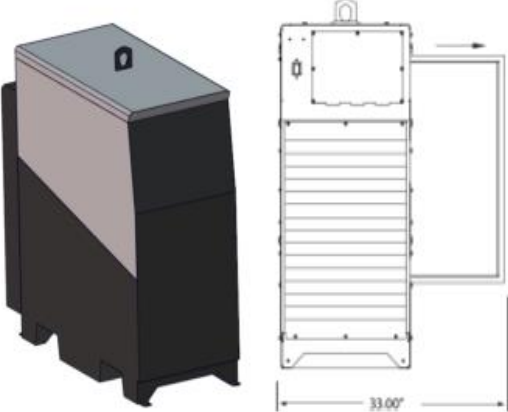
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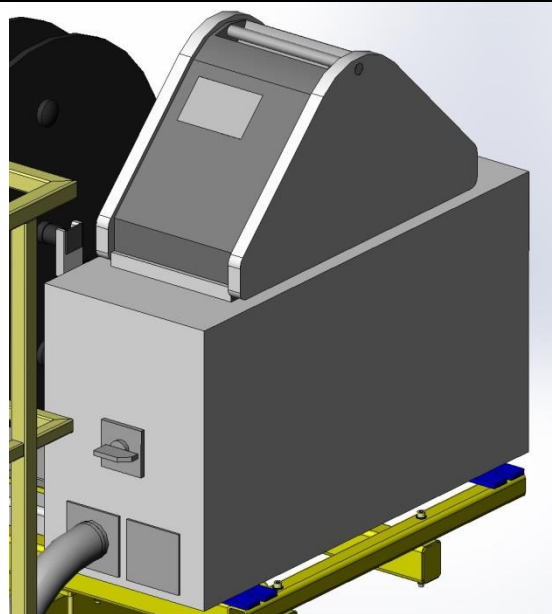
7.2 Welding equipment maintenance

Pema flux system Check regularly condition and weariness of flux hoses. Repair leakages or replace hoses instantly. Between the flux pressure tank and the cut-off valves control pressure (meaning the systems main pressure) the difference needs to be at least 2,5bars. The main pressure should be 6 - 6,5bars. Water level can be checked from the container window. Drain the water container at least once a month to ensure clean and dry air to the pneumatic equipment.	
Welding equipment Power Wave AC/DC 1000 SD In extremely dusty locations, dirt may clog the air channels causing the welder to run hot. Blow out the welder with low pressure air at regular intervals. The rear portion of the machine that contains the filter, the cooling fans and many of the heat sinks slides out for easy access. Removing the four clips and pulling back on the rear portion of the machine will provide access for cleaning the machine and checking the filter.	

EFD Induction heater

Check induction heater units own maintenance instruction.

See machines own manual for **special** maintenance instructions.



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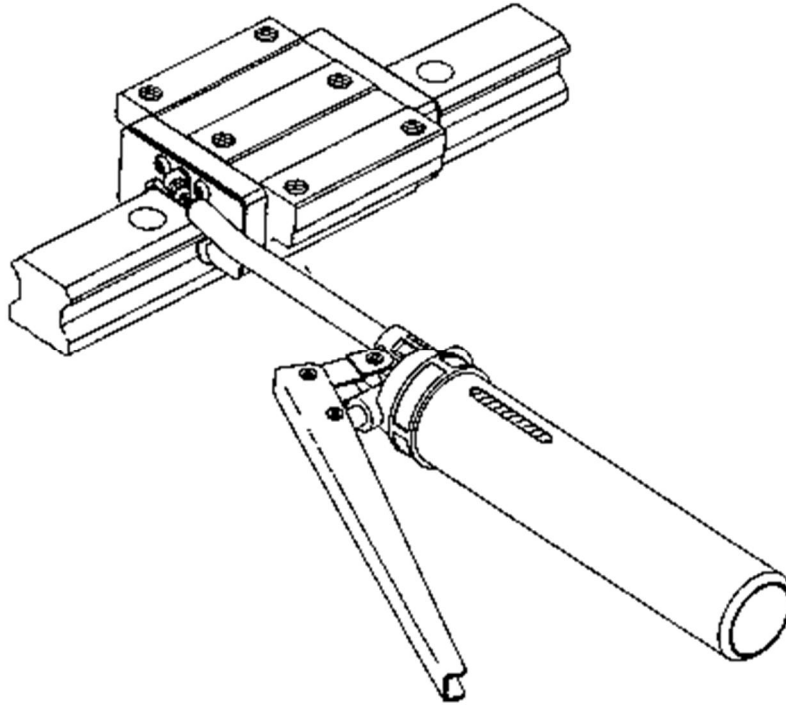
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7.3 Lubricating the linear motion guides



Lubricate linear motion guides with a grease gun.

Lubrication must be done carefully, avoid pressing too much grease at time. Too much grease damages bearing protections.

Service and lubrication for linear bearings and tracks

Linear tracks and bearings have a critical part in machine functioning. Linear tracks are exposed to humidity, dust and particles and for this reason maintenance plays a big part. With proper maintenance the life span is years, but if maintenance is neglected life span may fall into few months.

Maintenance includes two parts

Daily checking

Periodic maintenance

Daily checking should be carried out before every shift to make sure general appearance of the machine is good; tracks are clean and have a slight coating of grease on those. Visual inspection is enough. In case track looks dirty, wet from water or not lubricated, periodic maintenance should be carried out.

Periodic maintenance should be done by trained maintenance personnel. Maintenance period depends on machine working environment. Remember to carry out maintenance even the machine is not actively used.

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Standard period; No manual grinding in the shop. Low humidity. Filtered air inlet in the shop.

Track cleaning once a month

Linear bearing lubrication once in every three months

Compressed period; Manual grinding in the shop, open shop> dust from outside air, High humidity

Track cleaning twice a month

Linear bearing lubrication once a month

Instructions for periodic maintenance

Cleaning of the track is the first and very important task. Clean the track by cleaning spray and rag. If beginning of corrosion can be seen, use anti rust spray for example CRC Quickleen. If this doesn't help, contact Pema service for assistance. Don't try to remove rust mechanically by grinding or sand paper.

Lubricate the linear bearings by crease gun. Use only high quality grease. Cheapest one is not usually the best. It is highly recommended to use manufacturer's own grease. Avoid pumping too much grease in the bearing. Over filling can do harm to the bearing

After creasing drive the carriage from end to end of the movement area few times. This spreads the grease inside the bearing and on track as well.

Good way to protect the track from humidity is to end up the maintenance by wiping the track with oily rag. Thin oil layer (eg CRC Multilube) will give good protection against humidity.



Clean with rag and cleaning spray

7.3.1 Table for gear oil selection

ISO VG		MINERAL OIL			SYNTHETIC OIL			
		460	320	220	460	320	220	150
Amb. temp. [°C]		10° + 45°	0° + 35°	-5° + 25°	10° + 60°	0° + 50°	-5° + 35°	-10° + 25°
MANUFACTURER	ARAL	Degol BG 460	Degol BG 320	Degol BG 220	Degol GS 460	Degol GS 320	Degol GS 220	
	BP	Energol GRXP 460	Energol GRXP 320	Enerol GRXP 220	Enersyn HTX 460	Enersyn EPX 320	Enersyn EPX 220	Enersyn MTX 150
	ESSO	Spartan EP 460	Spartan EP 320	Spartan EP 220				
	AGIP	Blasia 460	Blasia OIL 320	Blasia OIL 220		AGIP Telium VSF 320		AGIP Telium VSF 150
	KLÜBER	Lamora 460	Lamora 320	Lamora 220	Syntheso D460 EP	Syntheso D320 EP	Syntheso D220 EP	Syntheso D150 EP
	MOBIL	Mobilgear 634	Mobilgear 632	Mobilgear 630	Glygoyle 80		Glygoyle 30	
					SHC 634	SHC 632	SHC 630	SHC 629
	SHELL	Omala OIL 460	Omala OIL 320	Omala OIL 220	Tivela OIL SD	Tivela OIL SC	Tivela OIL WB	Tivela OIL SA
	TEXACO	Meropa 460	Meropa 320	Meropa 220	Synlube CLP 460	Synlube CLP 320	Synlube CLP 220	
	CASTROL	Alpha SP 460	Alpha SP 320	Alpha SP 220	Alpha Synt 460	Alpha Synt 460	Alpha Synt 220	Alpha Synt 150

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