Operation Manual

ORBITAL WELD SYSTEM

ORBIMAT 250-C

CE

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V v.1

Contents of This Manual

1 INTRODUCTION

1.1 GENERAL INFORMATION

dear user,

we are pleased that You have decided to purchase our machine. We have worked hard to make a machine, which is programmable without the necessity of using a pocket calculator, tables and that usual tangle of paperwork ! This machine stores all the information necessary for safe reproducing of reliable welds. We have also supplied a comfortable recall of stored information. We are confident that this machine fulfills excellent prerequisites for the performance of welding seams in accordance with high safety requirements as well as for certified quality standards.

It is a goal of this documentation to supply You, who have the responsibility for operation or maintenance of this system with optimal information which will enable You to the full as easily as possible within Your company.

In order to avoid damage or injury to personell or other persons in the use of this machine, we wish to stress that serious attention should be paid to the safety information.

Legal reasons force us to occasionally repeat information in certain areas that may be self-evident to You.

We have tried to differentiate between the needs of operator and those of maintenance people, although this are one and the same. With reference to safety needs in particular, it is necessary that this documentation is available for both working groups.

It is worthwhile to invest a little time finding the sections of particular interest to You and to secure ways in order to look-up these sections quickly should a problem arise. In doing this, feel free to make Your own personal remarks.

Please note that any disregard of this documentation can lead to danger of injury to persons and to damage to the system and that the responsibility in such cases must be borne by You, the operative.

During the warranty period (and after ist date of expiry) You may use only use approved spare parts. Failure to do so will lead to the loss of warranty as well as to the invalidity of the CE-certification. We wish to remind, that Your company would then be legally obliged to carry out the legal requirements itself.

Best wishes for a successful plant operation

Your documentation team

1.2 DOCUMENTATION STRUCTURE

The structure of this manual is arranged in a form to make the desired topics easy to find. The topics are arranged according to the expected frequency of use. The more frequently searched for topics are placed in front. Please also regard the independent operating manuals for tube interior forming and weld-heads. For direct accesses please use the respective table of contents.

All keyboard instructions are located in this guidance in <arrow-marks>, menu instructions are located in [square brackets]. For the system dependent danger precautions please see particularly the chapter 2.2 Precautions

1.3 WHEN YOU ARE REALLY STUCK

In the case of unclear disturbances at the machine (we hope, that this does not occur too often) and for spare part needs, Your further inquiries are welcome. (unfortunately we can help You only during usual office hours.)

In these cases please call Phone : **((49) 64 08) 90 26-0**

(Our switchboard will connect You with the competent partner)

Fax enquiries please at: **((49) 64 08) 90 26-50**

(We also promise immediate reply)

In each case You should give the type of machine and serial-number (according to system identification plate and this manual).

2 OPERATION

For better understanding, in this manual keyboard instructions are given as <arrow-marks> menu instructions as [square brackets].

Double-key-functions are represented with a hyphen; the aformentioned key must be first pressed and be held during input by the second key.

2.1 SYSTEM-SCHEME - OPERATION ZONES

This plant is conceived for use in varying work-places. The operation (including the product-specific set-up) can take place from all sides of the machine.

2.2 PRECAUTIONS

One of the important duties of this manual is to protect You against injuries and harm and to enable a reliable operation of this system.

For working with welding machines there often exist legal restrictions, which are subject to changes in the course of the time. Ask Your specialized supervisor about possible restrictions in operation at this time with this machine

Before beginning of work with the system please be informed about **application safety** and rules for the prevention of accidents and fulfill the requirements in the own interest. In principle this operation manual assumes a system-specific briefing for the operators before beginning of work. The manual also assumes, that the technical personnel of this plant has an appropriate technical training and also acts with consideration for the rules for the prevention of accidents.

Transport of the plant to the place of work should always be performed with consideration for the associated rules for the prevention of accidents. For set-up on site always make sure, that the plant cannot topple over or be pulled over by tripping over the cables.

The security concept assumes a "One Man Operation ", operation with coworkers can cause additional dangers.

Please always **use** the specifically assigned **protection equipment** for the respective application, which should also protect You against electrical voltages! The voltages, arising from this plant, are not classified as dangerous. Nevertheless, danger of accident exists by fright during coincidental, unexpected contact. In this context, we recommend as a precaution, that persons with heart defect or special sensitivity to electrical voltages do not work with this system.

Make it habit, **never** to **touch** either the weld-head or the workpiece at the time of arc ignition.

With regard to electric influences, damp clothes should always be avoided. Also, the protection equipment can lose their function under the influence of humidity.

In order to avoid inadvertent ignition function, You should always switch the system off for connecting or separating a weld-head.

The arc welding gives off ultraviolet radiation, which can cause **eye injuries** as well as skin burns. Protect Yourself against the intensive light of the welding-arc!

After extended use of the plant the coolant can be strongly heated up. Disconnecting the coolant-leads can lead to burn danger both affecting the patch cords and by the coolant.

Always consider the safety precautions given by Your specialized technical or safety representative! Always observe the safety regulations, which concern other parts of the plant. For example the handling of containers for pressurizes gases.

With the use of reactive welding gases and portions of it, please refer to the relevant safety data sheets!

Before switching the system on, make sure that no solvent gases in the room air are present and and make sure Your working area is free fromm inflammable gases at all times.

Before beginning of Your work make sure, that no inflammable materials come into the welding zone (danger of fire). When in doubt, always ask qualified colleagues for assistance.

Before weldings at pipes or containers, which contain inflammable or explosive materials or residuals of them, agree upon Your procedure appropriately with Your specialized supervisor.

Do not use inflammable materials in the proximity of or as support for the welding zone. Please note also that contamination can often be inflammable! Please always consider the burn danger, which proceeds for a considerable time from the welded joints and that after welding machine parts (in particular the burner area of the weld-heads can be hot).

During welding jobs, the materials used thereby and possibly existing contamination vapours developing at the weld, could be injurious to health. Always make it a habit to avoid inhalation of these vapours.

Before beginning Your work make sure, that the workpiece is not under pressure!

Use exclusively fully-insulated electrical appliances in the work area of the system. Devices with protective grounding can be damaged by high electric currents when welding and cause danger to life. If necessary, inform colleagues, working close by, of this risk.

Pay attention also to the surrounding field of the plant and prevent damage caused by a third party!

Also do not start ignition, if no weld-head is attached or is not in welding position. That would possibly lead to arc ignitions on non-intended places and could cause a very unpleasant experience for the "player" and/or other persons to injuries and expensive damage in the control computer. If the plant is not in use, as a precaution please always switch into "Test"-mode.

Erroneous ignitions also can damage electrical safety devices. Such damaged safety devices can cause danger to Yourself and others!

Something similar applies also for a damaged welding current cable, which can ignite unwanted arcs and cause injuries, and also damage to the operational grounding system.

If disturbances at other electrical devices should be caused, in particular by the arc ignition, please immediately call a specialist for inspection.

Pay attention to never placing liquids (beverages) on the plant. These can fall and leak into the plant. Beside the damage to the system, as an operator You could be exposed to dangerous electrical voltages.

Keep the louvers of the system free from blockage.

Always ensure that this system is in a good shape by careful handling. In case of discrepancies organize examination and repair immediately.

As a more experienced user, Your supervisor will set operating parameters, which should be maintained during the execution of the work. Disregard of these values can lead to insufficient welds, which can cause heavy accidents with personal injuries, high economic damage for Your company and also for You personally. Sometimes one discovers the importance of individual values later on!

But back to this manual.

In the relevant passages in the text of this manual You will find remainders of dangers, which are caused by the system and which could not be avoided by the system concept:

☞	Notice:	This note refers to dangers, which can cause damage at the system or to the product.
✋	*Attention:*	*This note refers to dangers, which can cause injuries for operators, technical personal or unconcerned persons in the working area.*
☠	***Danger:***	***This note refers to dangers, which can cause danger for life or heavy injuries for operators, technical personal or unconcerned persons in the working area.***

2.3 PREPARATIONS FOR WELDING

2.3.1 Set-up

Assumption/Status	Action	Function
System placed in a safe position?	Secure against sliding down or falling over; lay power-supply-cable protected and connect to system; e.g. the cable should be protected against damage and not cause trouble to others;	
	connect weld-cable "+“ to the workpiece; (except cassette-weldheads)	

2.3.2 Switch-on Power

Assumption/Status	Action	Function
	Mains "on";	
Loading the software, some patience, please. At the last operation, the status has been stored. After switching the system "on", the active-procedure of the last operation is loaded automatically. Additionally, the same screen is loaded, with that which was loaded before the last switch-off;		
Can You read the display?	Adjust brightness;	<Menu>-<↑> or <↓>
If You're ready with the preparations (acc. 2.3.4) :	continue according 2.4	

2.3.3 Loading a Weld Procedure

Assumption/Status	***Action***	***Function***
The power is on:		<Menu> [SELECT NEW PROCEDURE]
The system asks, whether You want to load from the internal memory or from a Memory Card:	choose!	<Enter> or <↓> <Enter>
	move the cursor to the selected procedure	<arrow-keys>
If a procedure is marked, the procedure comment is displayed. That gives You adittional information for procedure selection	confirm Your choice:	<ENTER>
The choosen procedure-name is displayed (top-left)	correct? If not:	 repeat the procedure
	input weld-nr. (if necessary)	<Menu> [WELD] <cursor-keys> <number>
If You want to correct the weld current:	move the cursor onto the respective value	[Menu] [WELD] <↓>
	input the desired value	<number>
☞ Notice: In key-swich position "weld", the variation of parameters is limited to the adjustments in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS]		
If input wrong:	delete input:	<Del>
If input correct:	confirm:	<ENTER>
the procedure is stored in the active memory as active procedure;		

2.3.4 Preparations

Assumption/Status	***Action***	***Function***
APPLICATION SPEC. are visible;	look into APPLICATION SPEC. or: print weld procedure: choose:	<Menu> [BASIC AD-JUSTMENTS] [APPLICA-TION SPEC.] [PRINT] [ONE WELD PRO-CEDURE] <Arrow-keys> <Enter>
	connect the weld-head, cited in the weld procedure;	
	connect the weld-gas, cited in APPLICATION SPEC;	
☠ ***Danger: Connection of weld-gas only by suitable pressure control!***		
Bottle secured?	secure and connect; open bottle valve;	
Is the seam-preparation perfect?	We reccommend use of the ORBIMATIC-tube facer modell-line X.SQ ... or tube-saw-line RA... In doubts please regard point 6.3	
Weld zone clean?	self-explanetory, or?	
	put the weld-head into the procedure-specific weld-start-position; (see APPLICATION SPEC.) regard the operation manual of that weld-head;	
Tube inside purge prepared?	regard the operation manual of the tube inside purge device. To secure the proper function of the tube inside purge we recommend the use of ORBIMATIC-oxygen-gauges ORB 10 or ORB 100	

2.3.5 Connect Weld-Head

Assumption/Status	Action	Function
The connectors for the weld-head are located at the front-side of the system	First, plug-in both coolant-connectors; (These both connections are exchangable.)	
	Plug-in the connector for weld-gas;	
	Plug-in the weld power-plug into the connector, marked with "-"; connect the work-piece-cable into the other connector; (except for cassette-weldheads)	
	Finally connect the control-cable. Inspect the connections.	
The control system checks whether the connected type of weld-head and the programmed weld-head are identical		
LED is on, gas flows: after 20 seconds flush-time:	flush the weld-gas connection: gas off:	<GAS> <GAS>
together with the function <Gas> the coolant-pump is always started:	check the seals of the coolant connectors;	
If the weld-head is not in upright position:	turn the electrode into weld-start-position; at open-arc-weldhead: disengage coupling, turn, engage coupling again; concerning start-positions, please regard pos. 3.2.7.3;	

2.3.6 Motor Calibration

This function is available only, if a cassette-weldhead is connected.

The system can store one correction value for one model of each weld head.

If the last motor-calibration for this type of weld-head was performed with this particular head, the correction values are already stored.

Assumption/Status	Action	Function
There can be differences between different models of the same weld-head-type, which should be measured by a test-run and stored:	Motor calibration	<Menu> [MOTOR CALI-BRATION]

2.4 START WELDING

Assumption/Status	Action	Function
	check, whether the necessary weld-procedure is loaded;	
Is the "welding"-LED on?	Switch system ready for weld;	
Is the amount of weld-gas adjusted correctly?	For check: switch gas on, check and correct gas-flow switch gas off;	<Gas> <Gas>
Tube inside purge ready for operation?	Regard the respective manual;	
Supply weld-gas and wire sufficient for this weld?	Check;	
Weld-menu displayed?	Weld / Modify Procedure	<Menu> [WELD]
 *Attention: Danger from ignition voltage, if weld-head is not in weld position or if workpiece-cable not connected!*		
	Start;	<START>
The weld-gas starts flushing; the coolant circulation is started; after elapse of flush-time: the weld-voltage is switched on; the ignition-voltage is switched on; the weld-arc ignites: after elapse of the motor start delay: the head-drive starts, optional: the wire-feed starts;		
Now, the weld-parameters have to fit!	Check, **correct** if necessary: - Arc-current, - Arc-voltage, - weld-speed;	

2.5 WELD-OPERATION

Assumption/Status	Action	Function
✋ *Attention: Avoid breathing the weld-vapours !*		
Now, the system works automatically. But: Quality is determined only by You! To make it good and enduring,	 check permanently: Weld parameters; heat penetration; look of the seam;	

2.6 WELD STOP

2.6.1 Fast Stop

Use of this function is forseen for the case of a hole in the workpiece or in case of danger for contact between electrode and workpiece

Assumption/Status	Action	Function
In case of trouble:	Cease!	<STOP>
the arc is switched off instantly, After elapse of the gas postpurge time, the gas purge is shut off, the coolant circulation is stopped,		
	Switch the system into "test"-mode (LED off)	

2.6.2 Controlled Stop

Use of this function avoids the creation of a weld-end-crater and maintains the prerequisites in order to repeat the weld.

Assumption/Status	***Action***	***Function***
In case of trouble:	finish the weld	
the system reduces the arc-current according to the procedure, the arc is switched off, after elapse of the gas postpurge time the gas purge is stopped, the coolant circulation is switched off,		
	Switch the system into "test"-mode (LED off)	
Attention: Burning hazard at the workpiece and in the weld zone of the weld-head!		

2.7 WELD-END

Assumption/Status	***Action***	***Function***
At weld-end:	The weld process is terminated at the weld-end automatically	
The system reduces the arc-current according to the procedure, the arc is switched off, after elapse of the gas postpurge time the gas purge is stopped, the coolant circulation is switched off,		
	Switch the system into "test"-mode (LED off)	
Attention: Burning hazard at the workpiece and in the weld zone of the weld-head!		
	Remove weld-head; regard the operation manual of the weld-head ! Check the weld.	

2.8 SYSTEM SHUTDOWN

To shut-down the system for work on the system (also over night or over the weekend) switch-off the main-switch.

2.9 DISTURBANCES

2.9.1 Trouble-Shooting

All disturbances, identified by the system, are declared on the display.

In most cases, these displays are self-explanetory. Afterwards, the most common disturbances are explained.

Assumption/Status	Possible Reasons	Action
No weld gas:	bottle shut-off: bottle empty; gas-flow adjusted too low; pressure control adjusted too low; burner noozle stuck;	open bottle exchange; adjust higher; adjust higher; clean;
Coolant circulation disturbed:	tank level too low: hose sharp bended:	refill; clear;
Arc strike time limit over	electrode disturbance: flush-time is set too short: strike current too small:	check electrode; regrind, if necessary; check distance adjustment, set gas-prepurge-time to higher value; set higher value;
System fault: Check printer/Memory Card	no paper or paper jam: printer connection disturbance: Memory Card not plugged-in correctly: Memory Card defective:	insert paper correctly; check printer cable; plug-in correctly; check this Memory Card in another system;

Assumption/Status	***Possible Reasons***	***Action***
File cannot be written (Data medium full?)	system memory full:	store the data-log-files onto Memory Cards and delete these files in the system memory; or: print the data-log-files and delete these files in the system memory; or: Memory Card full, use another one;
Arc extinguished:	arc extinguished:	reduce electrode distance increase the input-values for high pulse current/low pulse current;
Arc short-cut:	short-cut in the weld-circuit:	check the electrode-distance; check centricity of the weld-head adjustment on the workpiece;
Inverter reports overtemperature:	overtemperature	keep the system switched-on, input <ENTER> occasionally, after cool-down the report will be confirmed and You can continue to work;
Inverter reports undervoltage:	one of the incoming phases is missing: cross-section of the cable extension too low: cable extension too long:	check the power fuses of the outlet; use cable extension with higher cross-section; use shorter extension;
System doesn't start:	fuse of control-circuit defective;	check control-fuse on system-front; have an electrician check the board-fuses (2)

2.9.2 Error-Reports from the Weld-Procedure

While inputting the system checks for admissibility, expecially with regard to the possibilities of the respective weld-head.

E.g. You have an approved procedure. You call-up another weld-head. Now it's possible, that some parameters are not permissible for the new weld-head.

In this case, the system reports "One or more data in the weld procedure exceed the capabilities of the weld-head“. Below that report, there is a number. This number is to help find the impermissible value. The meaning of these numbers is discribed below:

(3)	arc-current value;
(4)	resulting welt-head-speed too high;
(5)	wire-speed too high;
(6)	announced weld-head has no wire-feed, procedure is with wire-feed;
(7)	reserved;
(8)	reserved;
(9)	reserved;
(10)	tube-diameter too large;

If You get this report, please change the weld-procedure-data accordingly.

2.10 MACHINE CARE

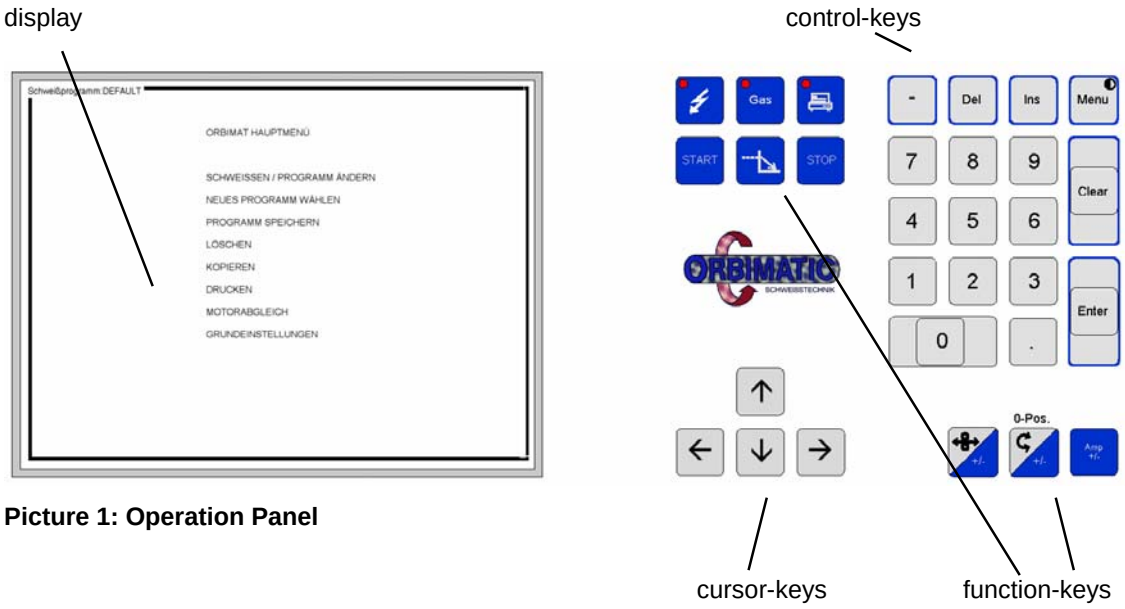
2.10.1 Operator Services

after each weld-head change	switch on <Gas> for about 30 s afterwards, check coolant-filling-level;
every day	wipe-off the display;
	check coolant-filling-level;
every month	clean system-housing with a wet cloth (when power off);
	clean the printer;

2.10.2 Technical Services

every month	check the plugs;
	check the anti-freeze-content in the coolant;
every year	clean the system inside with compressed air carefully;
every second year	replacement of the Memory Card-batteries;
	replacement of the system-buffer-battery;

3 OPERATION ELEMENTS AND -FUNCTIONS



Picture 1: Operation Panel

Additionally there is a dose-valve for the adjustment of the weld-gas as well as a sight-glass for inspection of the coolant-level.

3.1 KEY-FUNCTIONS

3.1.1 Display Brightness

For display-brightness-adjustment You push <Menu> (and hold that key) and additionally You push <↑> for lighter or <↓> for darker display until the desired brightness is achieved.

3.1.2 Key-Switch

3.1.2.1 Weld-Position

At this position of the key (slit) the system is in regular welding-mode. Within this mode, You can callup weld-procedures, weld with stored procedures as well as print-out stored procedure-data. This switch-mode also protects the stored procedures from modifications or deletion.

For input or modification of weld-procedures as well as for modification of the "BASIC ADJUSTMENTS", the key-switch must be turned to setup-position.

3.1.2.2 Setup-Position

This swich-position gives You a maximum access to modify the system's opportunities, while the safety-functions for welding remain active.

3.1.3 Keys

Use of some of these functions lead to changes of the respective parameter in the "active procedure“. These changes remain stored until the next switch-off.

3.1.3.1 Flare Key Welding/Test

This key serves switching between the functions "welding" and "test". If the LED is on, the function "welding" is activated.

In function "welding", <START> leads to execution of the selected (active) weld-procedure, if the main menu point "WELD/MODIFY PROCEDURE" is selected.

In function "test", <START> leads to execution of the selected (active) weld-procedure. But the weld arc as well as the purge of weld-gas are not activated!

3.1.3.2 Flare Key GAS

Use of this function leads to flow of weld-gas at the adjusted amount. If the "LED" is on, this function activated. Use of this function also automatically starts the coolant circulation pump.

Tis function can only be used with a non-welding (waiting) machine. During the welding process, this key has no function.

3.1.3.3 Flare Key Printer

Use of this function (before START) causes a print-out of the weld protocol immediately after the weld procedure is terminated.

If the "LED" is on, this function is activated.

3.1.3.4 Key START

Aktivation of this function leads to the immediate execution of the selected (active) procedure. Prequisite therefore is, that the main-menu-point " WELD/MODIFY PROCEDURE " is acitvated.

In function "welding" (regard 3.1.3.1) the procedure is entirely, in "test“ is executed without welding arc and -gas.

3.1.3.5 Key Weld-End

Use of this function causes a controlled termination of an executed weld-procedure. That means, that the arc-current is ramped down (according to the procedure data) and then switched off.

That procedure avoids a weld-end-crater and permits a new weld without loss of quality at this spot.

3.1.3.6 Key STOP

Use of this function causes an immediate switch-off of the arc-current and thereby to a uncontrolled interruption of the weld. Gas postpurge is performed according to the procedure data.

Use of this function mostly causes the creation of a weld-end-crater, which probably influences the quality of a new weld negatively.

3.1.3.7 Key Wire-Feed (optional)

This key has function only if a weldhead with wire-feeder is connected and wire-feeding is activated in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

At welding system, use of this function (first push this key and hold) together with <↑> leads to an increase of the programmed wire feed rate. Use together with <↓> leads to reduction. The range of possible influence is limited in key-switch-position "weld“ over [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

Such a variation is stored automatically in the active procedure.

Use of this function together with <↑> at a not-welding-system leads to wire-feed with half of the maximum feeding-speed. Use together with <↓> leads to wire-pull-back.

3.1.3.8 Key Head-Drive

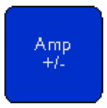
At welding system, use of this function (first push this key and hold) together with <↑> leads to an increase of the programmed weld-speed, use together with <↓> leads to reduction. The range of possible influence is limited in key-switch-position "weld“ over [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

Such a variation is stored automatically in the active procedure.

Use of this function together with <↑> at a non-welding-system leads to rotation of the weld-head with half of it's maximum clockwise turning-speed. Use together with <↓> leads to the same speed in the other direction.

Use of this function (alone) leads the weld-head to turn into it's 0-position. (if the weld-head can provide this function)

3.1.3.9 Key Arc-Current



At welding system, use of this function (first push this key and hold) together with <↑> leads to an increase of the programmed welding-current (high pulse - and low pulse current in the same ratio). Use together with <↓> leads to reduction in the same way. The range of possible influence is limited in key-switch-position "weld“ over [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

Such a variation is stored automatically in the active procedure.

3.1.4 Control Keys

3.1.4.1 Key Menu

Use of this function will get You the main menu, independant from the actual system status.

3.1.4.2 Key Clear

Use of this function deletes the last input and regenerates the last values.

3.1.4.3 Key Ins

Use of this function inserts a level-parameter-screen. Details are given on the Display, if the prerequisites are given.

3.1.4.4 Key Del

If a level-parameter-screen is being displayed, use of this function leads to deletion of this level-screen with all it's data.

3.1.4.5 Key -

This key is used before input of negative numbers.

3.1.4.6 Cursor-Keys

The cursor is the blinking spot on the display, where the next input will appear. Often, the concerned input field area is marked automatically (dark background).

This input-mark can be moved over the display by use of these keys to the desired position. At this position You can choose data input, changes or deletion.

In key-switch-position "weld“, the cursor jumps over blocked fields.

Additionally, these keys are used to switch between the different screens.

3.1.4.7 Number-Keys

These keys are used for numerical inputs into the parameter fields in the different screens.

After input data, they are confirmed by <Enter>. Erroneous inputs are deleted by <Clear>, the old data are recovered automatically.

3.2 SCREEN-FUNCTIONS

Dependant on the selected menu-function, different screens are displayed. Afterwards these screens are explained.

Additionally, the system serves many functions, which are accessible over their screens only.

3.2.1 SELECT NEW PROCEDURE

After choice of this main-menu-item the system asks to load from [INTERNAL MEMORY] or [MEMORY CARD]. The cursor is positioned on [INTERNAL MEMORY] automatically.

If You want to load from the internal memory, You confirm by <Enter>; from the Memory Card <↓> and then <Enter>.

After that, a list of the stored procedures (procedure-names) is displayed.

These procedure-names can be accessed by the cursor and be thereby marked. To make the choice easier, a comment (to the marked procedure) is displayed in the lower area of this screen.

After confirmation by <Enter> the marked procedure is loaded as active procedure. The following choice of the main-menu-point [WELD] and following <START> leads to direct execution of this procedure.

3.2.2 SAVE PROCEDURE

An active procedure, that has been created or modified is mentioned as "unsaved" in the upright corner of the display. That is a reminder not to forget storage of this procedure.

After selection of this main-menu-item and the question internally/Memory Card (regard 3.2.1) the memory screen with the already stored procedures is displayed.

Now, You input a procedure-name and confirm it by <Enter>. Afterwards You input a procedure-comment (concerning the procedure use) and confirm by <Enter> again.

Procedure-names may consist of up to 8 characters. Use of special characters is not permissible!

For input of comfortable procedure-names and especially the procedure-comments we recommend to use a PC-keyboard. (regard 3.9)

3.2.3 DELETE

You can delete data-log-files and weld-procedures. After execution of this delete-function, they are really gone. So, think before push the keys!

The active procedure is deleted by loading another procedure, which becomes the active procedure.

Deletion of weld-procedures (with their comments) and log-files is only possible in key-switch-position "set-up-menu“.

After selection of this function the system asks what (one or all weld-procedures or protokols) and then where (internal memory or Memory Card) to be deleted. After that the system displays the list of the stored procedures or protokol files.

To delete a file (procedure or data-log), You mark it and confirm by <Enter>. After confirmation of the safety-question this file is deleted!

With automatic data-log (regard 3.2.7.1.5) these data are written into the memory automatically, which can use the entire memory after a reasonable while. After printout or copy onto a Memory Card these files must be deleted manually by this function!

3.2.4 COPY

This function is dedicated to copy weld-procedures from the internal memory onto Memory Card or opposite. On request, You mark Your intentions. First, plug-in Memory Card!

A weld-procedure can also be copied by loading as an active procedure and storage (changed or not) with new file name and comment.

3.2.5 PRINT

This function serves the following list of opportunities:

3.2.5.1 WELD PROCEDURE OVERVIEW

This function prints a list of the internally or externally stored weld-procedures.

3.2.5.2 ONE WELD PROCEDURE

This function prints the procedure data of an internally or externally stored weld-procedure.

This print includes:

- procedure name;
- comment;
- pre- and post-parameters;
- all data of the programmed level-parameters;
- programmed PARAMETER LIMITS, in case that printout is set in this screen;
- all data of APPLICATION SPEC., in case that printout is set in this screen;

3.2.5.3 ALL WELD PROCEDURES

This function prints the procedure data of all procedures, stored internally or externally.

3.2.5.4 DATA LOG FILE OVERVIEW

This function prints a list of all data-log files, stored internally or externally.

3.2.5.5 ONE DATA LOG FILE

This function prints the data of a selected data-log file (stored internally or externally).

After marking the file-name at selection, an automatically generated comment is displayed, which includes the executed procedure name and the weld number.

3.2.5.6 ALL DATA LOG FILES

This function prints the data of all data-log-files, being stored internally or externally. (This takes time. Have You enough paper available?)

3.2.6 MOTOR CALIBRATION

This function is available only with cassette-weldheads and enables the correction of head-speed-tolerances.

The generated correction-data are stored with the head-type and should be replaced by re-execution of this function, if another model of the same head-type is connected to the system. We also recommend to re-execute this function after approx. 50 hours of work with this weld-head.

3.2.7 BASIC ADJUSTMENTS

All Yes/No inputs can be made on the system-keyboard by pushing 1 for Yes and 0 for No.

3.2.7.1 SYSTEM ADJUSTMENTS

The adjustments, discribed afterwards, belong to the active procedure and are stored with it. Just the system time is in general use.

3.2.7.1.1 Tacking

Tacking Y(es) or input 1 causes activation of the tack-parameter-screen, (regard 3.3.4) which is accessible from the pre- and post-parameter-screen by means of <←>. The activated and programmed procedure is performed before every weld. Tacking N(o) or 0 deactivates this function for the active procedure.

3.2.7.1.2 Wire Feed Option

Weld heads, beeing equipped with wire-feed-system can only use it, if this option is activated.

3.2.7.1.3 Override Limit

Here is set a range (in %), within which an operator can modify the given procedure-parameters in key-switch-position „weld“. Higher changes will be refused by the system.

3.2.7.1.4 System Time

This system-clock is used for data-logging. Wrong setting causes wrong data-logging.

3.2.7.1.5 Data Log File

After activation of this function all welds will be data-logged automatically. The generated files are stored automatically and can be printed or copied onto a Memory Card at an other time. The names of these data-log-files are automatically generated as numbers. You can read the time of a given weld from the generated file name. The meaning of this group of numbers is:

MMDDhhmm.

3.2.7.2 PARAMETER LIMITS

In this screen the limits are set when the alarm is given (by display or remote control) and/or when the welding is to be interrupted.

The adjustable limits are to be understood as differences to the programmed data. Please remember, that only the welding voltages are understood as absolute values due to unprogrammed parameters.

This screen also includes the preselection, whether these screen-data are printed together with the other procedure data.

These screen-data are valid only for the active procedure and they are stored with it.

3.2.7.3 APPLICATION SPEC.

This information is important for the weld quality as well as the weld parameter. It is attached to the weld-procedure and is stored with it.

The start-position means the position of the electrode at the beginning of the weld. This electrode position results from an upright weld-head-position. In case of different weld-head-positions, the operator has to induce the according electrode (start) position. This means for:

- cassette-weldheads	3-o'clock-position
- open-arc-weldheads	9-o'clock-position

It is recommended to perform these inputs by a PC-keyboard. (regard 3.9)

This screen also includes the preselection, whether these screen-data are printed together with the other procedure data.

3.3 DISPLAY-SCREENS

3.3.1 Main-Menu-Screen

This screen is attainable in any situation of the control-system by push of the key <Menu>.

The menu-points, displayed, are dependant on the position of the key-switch. (regard 3.1.1)

In key-switch-position „set-up-menu“ everything is accessible and can be changed with regard to the capabilities of system and weld-head.

In key-switch-position „weld“ only the menu-points:

- WELD
- SELECT NEW PROCEDURE
- PRINT
- MOTOR CALIBRATION (only if a cassette-weldhead is connected)

are available.

3.3.2 Pre- and Post-Parameters

Calling-up the main menu point " WELD/MODIFY PROCEDURE“ serves the pre- and post-parameter-screen. Individual parameter fields can be accessed by the cursor and changed within the permissible range. In key-switch-position "weld“ the cursor jumps over restricted input fields. In this screen You also input the weld-number (usefully according to drawing)

The level-parameter-screen can be paged by <→> and <←>. (Level-parameter-screen regard 3.3.3)

If the key-switch is in "set-up-menu“ position, all weld-parameters can be modified. Hereby, the control-system watches the technical capabilities of power-supply and weld-head. Unpermissible inputs will not be accepted. (The system rules all actions. Don't try to cheat!)

Notation	***Dim.***	***Comment***
Tube/pipe O.D.	mm	value is stored with weld-procedure; value accessible only in "setup-mode"; only full mm permissible, straighten it!
Weldhead type		weldhead-type is stored in weld-procedure, no input necessary; for generation of a new weld-procedure, the weld-head must be detemined, therefore: push <1> and <Enter>; this weld-head does not existist; the display lists all weld-heads, being programmed; choose Your weld-head by means of the cursor-keys; confirm Your choice by <Enter>;
Start position	deg	this means a shift from the normal start-position; (clockwise) input may not be larger than final angle in the first level-parameter-screen
Gas prepurge	sec	max. 120 s
Gas postpurge	sec	max. 120 s
Strike current	A	max. 99 A
Final current	A	max. 25 A
Motor start delay	sec	max. 20 s; (it's the time to make a weld pool)
Final slope time	sec	max. 30 s
Weld-Nr.		multiple function, can be used for: recording, input of the weld-nr. according to drawing, input max. 8 digits; counting of the welds performed, put-in any start-number, every weld increases the number by 1; (After switching off the system, the last number is lost!) If You ignore input, the system counts from 0;
Corr.-coefficient	%	correction-factor for welding-current max.-value limited in key-position "weld“ in [BASIC ADJUSTMENTS] - [Override Limit];
Wire feed (optional, displayed only if activated and weld-head is equipped accordingly)		
Start delay	sec	Max. as motor start delay;
Stop delay	sec	Max. 10 s;
Wire retract	sec	Max. 5 s;

3.3.3 Level-Screen

Notation	*Dim.*	*Comment*
Tube/pipe O.D.	mm	is taken from pre- and post-parameters automatically;
Start angle	deg	is taken from pre- and post-parameters or from final angle in lower level-screen automatically;
Final angle	deg	angle or e.g. multi layer weld: 1085 = 3-fold + overlap;
Time	sec	weld-time, calculated automatically for given weld-angle under regard of HP and LP-travel-rate; You also can input a time, then the system calculates the final angle! (isn't that great?)
Slope time	sec	this is the time for arc-current-changes between two levels. This slope-time begins together with the level-time and may not be longer than "time";
High pulse current	A	limited by power-supply and weld-head-capabilities;
Low pulse current	A	min. 5 A
High pulse time	sec	Input between 0,01 und 1
Low pulse time	sec	Input between 0,01 und 1
HP travel rate.	mm/min	Limitation by weld-head;
LP travel rate.	mm/min	Limitation by weld-head; value is taken from HP automatically, but You can write over;
Wire feed (optional, displayed only, if wire feed is activated)		
HP travel rate	mm/min	Limitation by weld-head;
LP travel rate	mm/min	Limitation by weld-head;

All programmed level-screens can be displayed by means of <→> or <←>. The screen-contents are always identical, the data registered is valid only within the programmed angle-difference.

3.3.4 Tacking-Screen

This screen can be displayed only, if tacking is activated in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

Notation	***Dim.***	***Comment***
Number of tacks	tacks	Input limit 3 - 10; System distributes number over the tube-circumference symmetrically; welding is made opposite, not in line;
Tack current	A	10 - 50
Tack time	Sec	1 - 10;

3.4 REMOTE CONTROL (OPTIONAL)

3.4.1 Mushroom shaped Key System-Off

Push this key-button leads to immediate separation of the line-power. That stops all functions of the system.

For restart You need to unlock this button and afterwards switch the mains off and then on again.

3.4.2 Signal-Lights

3.4.2.1 On (green)

Light on means, that the system is ready. (Mains on and power available)

3.4.2.2 weld (red)

Light on means, that the system is in "welding"-mode; light off means "test"-mode. (regard 3.1.3)

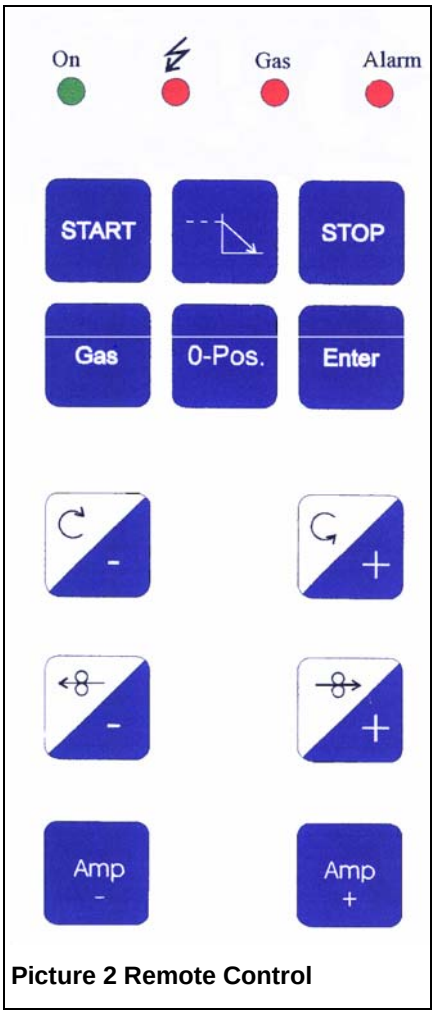
3.4.2.3 Gas (red)

Light on means, that the weld-gas is switched on.

3.4.2.4 Alarm (red)

Permanent light means, that the limits, set in BASIC ADJUSTMENTS, have been achieved, the system continues to work.

Flashing light means, that the weld was terminated due to exceeding parameter. You can restart after confirmation by <Enter>.



Picture 2 Remote Control

3.4.3 Function-Keys

3.4.3.1 START

This function is identical with 3.1.3.4

3.4.3.2 Downslope

This function is identical with 3.1.3.5

3.4.3.3 STOP

This function is identical with 3.1.3.6

3.4.3.4 Gas

This function is identical with 3.1.3.2, the function of the LED is identical with 3.4.2.3

3.4.3.5 0-Pos

If the system is not welding, this function leads the weld-head drive into 0-Position, but only in case, the weld-head is suitable for this function. While welding, this key is out of function.

Please also regard 3.1.3.8

3.4.3.6 Enter

This key is used to confirm error-reports according to 3.4.2.4.

3.4.4 Operation Keys

3.4.4.1 Weld-head Drive counter-clockwise

While execution of a procedure, this function leads to a reduction of the head-speed.

Otherwise, this function leads to turn the weld-head-drive counter-clockwise.

3.4.4.2 Weld-head Drive clockwise

While execution of a procedure, this function leads to an increase of the head-speed.

Otherwise, this function leads to turn the weld-head-drive clockwise.

3.4.4.3 Wire-Feed Reduction

This key has function only, if a weldhead with wire-feeder is connected and wire-feeding is activated in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

While execution of a procedure, this function leads to a reduction of the wire-feeding-speed.

Otherwise, this function leads to a pull-back of the wire. (Don't pull back too far or the wire will become stuck!)

3.4.4.4 Wire Feed Increase

This key has function only if a weldhead with wire-feeder is connected and wire-feeding is activated in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

During execution of a procedure, this function leads to an increase of the wire-feeding-speed.

Otherwise, this function feeds the wire at half the maximum speed.

3.4.4.5 Arc-Current Reduction

This function leads to a reduction of the high and low pulse current in the same ratio for the welding system.

3.4.4.6 Arc-Current Increase

This function leads to an increase of the high- and low pulse current in the same ratio for the welding system.

3.5 COOLANT

Cooling of the different weld-heads is made by a coolant circulation system with storage tank my means of a circulation pump. This pump and the cooler are switched automatically for welding. Circulation is also started parallel with the function <Gas>. In case of temperature increase of the coolant, the pump and the cooler are started until the temperature is reduced to the preset level.

On the system side, the connectors are self-closing, so that the supply can't pour out while the head is being changed.

For refilling, disengage the holders between power-supply and cooling-supply, lift the power-supply from the cooling-supply and put it just to one side. Now, the coolant supply-tank and it's opening are accessible. We recommend that premixed coolant is filled according to the sight-glass. Avoid overfilling!

3.6 WELD-GAS

Supply of the weld-heads is controlled by the system by means of solenoid-valve, flow-adjustment and flow-meter. Gas-feed is controlled automatically by means of the solenoid-valve. The quantity-adjustment is made at the flow-meter button.

☠ ***Danger: Connect the gas-bottle over permissible pressure-controller only !***

☠ ***Danger: Regard the safety data for this particular gas-mixture !***

The backup-gas system requires different pre- and after-purge times and should be made independant from the system.

3.7 PRINTER

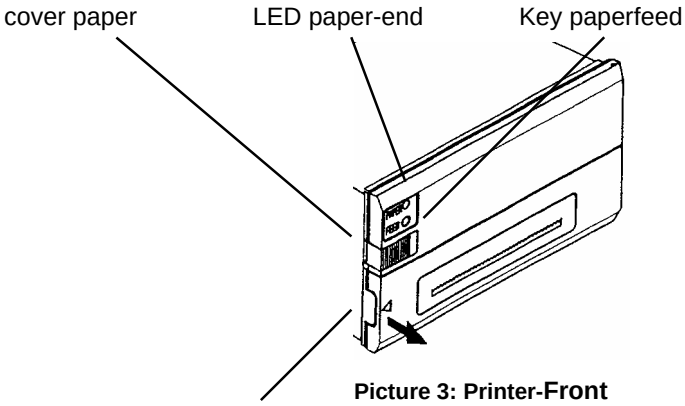
3.7.1 Internal Printer

This printer is a needle-printer with inking-ribbon and prints onto standard paper-strip of 57,5 mm width.

Attention: Danger of injuries! Service the printer only if system is switched off!

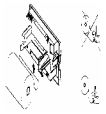
Notice: Danger for damage to the printer! **Never** print **without** paper and/or inking-ribbon!

Service this printer by towel only! In extreme cases, You can use an alcohol wetted cloth. Never use other solvents!



Picture 3: Printer-Front

3.7.1.1 Paper-Roll Change



Picture 4: Paper Insert

The printer stops at paper-end. Paper-end is monitored by the red LED on the printer-front.

Open the paper slot.

☞ Notice: Danger of printer damage! Make sure, that the paper-end is not folded. Do not pull-back the paper!

Remove the residual paper by pushing the feed-key (FEED).

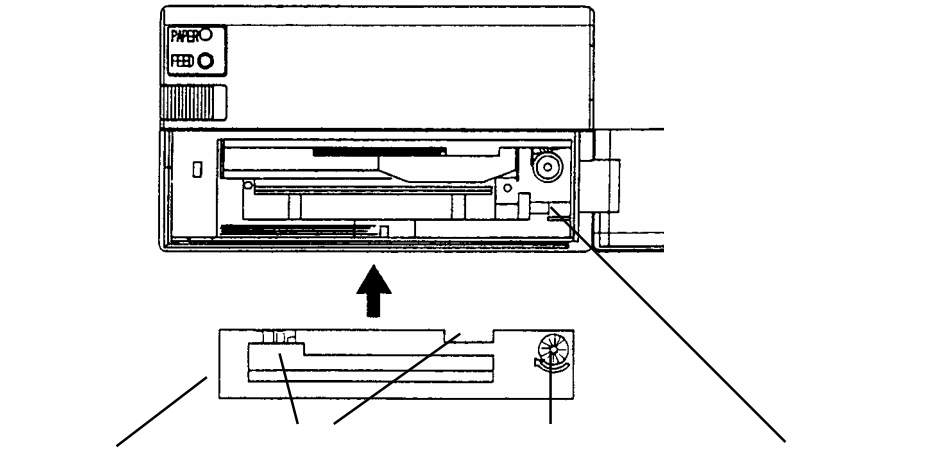
Thread the end of the new paper-roll into the transport-slit unfolded. It may be helpful to tear the paper end at an angle of approx. 45°.

Transport the paper by means of the feed-key.

Put the paper-roll into the unwind-position.

3.7.1.2 Changing the Ink-Ribbon

The ink-ribbon is contained in a cassette and is therefore ready for use.



Ink-ribbon-cassette grip-slots ribbon-transport-button cassette-cavity

For cassette-change, You open the cassette-cover and carefully pull the cassette from the printer. For that, use Your finger-nails and the grip-cavities.

For the new cassette, make sure the ribbon is tense and push it carefully into its functioning position. Afterwards, perform a short printing test.

3.7.2 External Printer

After removal of the rear printer-plug, marked LPT1 (which serves the internal printer), You can connect any printer by means of a standard printer cable. A printer-driver is not required, because the data are transferred as ASCII-format. Except CR-LF, no formatting is used. Please note, that the generated data-shape does not permit variations.

Theoretically, You can copy the generated data-logs onto a Memory-Card, transfer the data onto a PC with Memory Card drive and print them.

For the ORBI-PC-package, we would be pleased for Your enquiry.

3.8 MEMORY CARD

These elements consist of a plastic housing and are equipped with a contact strip on one side. Elements with the designation SCM and a storage capacity of up to 1 MB are usable. The Memory Cards are inserted from the rear into the Memory Card drive assembly. (left slot on the machine's rear side)

The Memory Cards are used for storing weld procedures and log files as well as for the transmission of the same from one plant onto others or onto PC's.

Opposite the contact strip, a slide switch is attached. In switch-position „WP" (Write Protect) a storage, deletion or changing of data on this Memory Card is prevented.

A semiconductor memory with a buffer batttery is integrated in these elements. The battery's life span is indicated as 2 years.

For data safety we recommend that You copy the stored data onto another Memory Card or onto a PC-harddisk.

3.9 KEYBOARD

For the generation of weld procedures, the use of an alphanumeric keyboard is helpful. Each commercial AT keyboard is connectable. It is plugged into the rear-side (close to the Memory Card). Connection of a keyboard can be done any time.

3.10 DATA SAFETY

Technical damage can occur with all technical devices. Including, if the battery of a Memory Card fails or due to an operator error?

In order to avoid the new-invention of proven and examined weld procedures, these must be security stored.

Practically this means that all new (examined) weld procedures in the system memory should be copied on at least one Memory Card (so You have everything at least twice).

It must be remembered, that the Memory Card-batteries also have a limited life.

The safe way to archive weld procedures and weld-logs is by print-out and filing.

With the ORBI-PC-package You can secure the weld procedures and the log-files on an office-PC even more safely and subject them there under the usual PC data protection. In the case of a procedure loss You can recover the procedure again and save the new input and errors.

4 PRODUCT-SPECIFIC SETUP

4.1 ASSUMPTIONS

For the product-specific setup, the following points have to be regarded:

- Fixation of join- and weld-characteristics
- Fixation of the workpiece-position
- Choice of the optimum diameter of the wire
- Fixation of workpiece-preparation
- Fixation of the weld-parameter
- Execution of a test-weld
- Inspection of the result
- Modification of the fixations, if useful and retest
- Storage of the weld-procedure under a senseful procedure-name

4.2 IN GENERAL

Considering the points above, this means practically the input of operational data into the control computer of the system.

For the first weld-tests with a new workpiece please consider the reference values given under 6.7.

In the following, the steps necessary for it are described in general way; subsequently, a practical example is shown.

Generation of weld procedures always takes place in the "active procedure". In order to keep this procedure, storage under a new procedure name is necessary.

In case, You want to prepare weld procedures at Your desk PC, please ask us for the ORBI-PC-package.(please also regard 3.10)

4.3 GENERATION OF WELD PROCEDURES

For the first test-welds, we recommend that You abandon the use of wire-feed. Later, if the other criteria of the test-weld are OK, it's time to decide for wire. The criteria for the use of wirefeed are:

- the desire to have a welding-build-up
- insertion of alloy-contents

Choosing the wire, we ask to take regard of the prescriptions for welding of that particular steel.

Generation of a weld procedure takes place in different steps:

- Investigate the sensful welding parameters, for help please refer to
  6.7 Typical Process Data
- Input of the resulting data;
- The start-position of the weld-head does not matter at one-level-parameter procedures.

  As soon as You insert adittional level-parameters, the weld-start-position requires definition. These are:

for open-arc-weldhead:	9-o'clock-position
for cassette-weldheads:	3-o'clock-position

  Motorized drive to this position is achieved by the function <0-Pos> on the remote control or on the operation panel, if the connected weld-head is suitable for this function. Otherwise, You turn the weld-head by the keys or by hand at open-arc-heads!
- Test-weld on a short piece of identical pipe in the same weld-position,
  for this test-weld, a seam on the pipe is enough, joining parts is not helpful at the beginning;
- optimize the weld-parameters and weld again;

4.4 PROCEDURE

4.4.1 First Step

Assumption/Status	Action	Function
key-switch in position "set-up“	switch on setup	
The mains is on, a weld-head is connected an in welding-position, the key-switch is in position "set-up-menu“:		[WELD/ MODIFY PRO-CEDURE]
	Input the pre- and post-parameter data;	
Pre- and post-parameter-screen completed?	Call the level-screen;	<→>
	Input the level-screen data;	
Inputs completed?	Turn the weld-head into weld-start-position;	
	perform test-run:	<START>
Test-run OK?	Switch ready for welding:	
System ready for welding?	Execute the test-weld	<START>
Is the result subject for improvements?	Modify the respective data	
	shift the weld-head to a new weld-zone	
	Execute a new test-weld;	

4.4.2 Partitioning into Levels (Segments)

If the result of the test-weld is still unimproved, it's now time to split the weld into partitions, therefore proceed in simple steps;

From the former test-welds You know, up to which point the weld was good. (make a good guess at the angle)

Assumption/Status	***Action***	***Function***
The pre- and post-parameter-screen is displayed:	change to level-screen 1	<→>
	Input the number of degrees of the final angle (up to the weld was good)	
	Insert a new level-screen:	<Ins>
level-screen 2 is displayed:	Change the respective parameters according to Your welding-experience;	
	Input the final angle for the necessary overlap a final angle of 365 ° is recommended;	

You have realized, that the system calculates the (weld)time by itself automatically. That saves the inconvenience of calculating, checking and sometimes, to find out, that the calculation was wrong. Isn't that comfortable?! Following this procedure (You will also find others) You can solve Your weld-job easily.

4.4.3 Insertion of a Level-Screen (Segment)

Sometimes, You have a weld-procedure, which already works well except in a certain area. So, You want to insert an additional level-screen.

For this case, we assume, that the procedure consists of 5 level-parameters and You need a new level on the second position.

By means of the arrow-keys <→> or <←> You call the actual level-parameter-2-screen and push <Ins>. The system inserts a new level-parameter 2 and shifts all following level-parameters to a higher number in the given sequence. Input the desired parameters into Your new level-screen 2 and correct the final angle in the following level-screens.

Weld-procedures should be as simple as possible. Unnecessary level-screens are deleted by <Del>. (Afterwards You need to correct the final angle of the following level-parameter-screens).

4.4.4 Tacking

This function is provided for the use with cassette-weldheads only. It is helpful to avoid a distort of thin stainless tubes.

This function is accessible only if it is activated in [BASIC ADJUSTMENTS] - [SYSTEM ADJUSTMENTS].

4.4.5 Input of APPLICATION SPEC.

For the successful use of a proven weld procedure, the boundary conditions need to be fulfilled. These are not perceptible from the weld procedure data. For the storage of the surrounding field information You select [BASIC ADJUSTMENTS] - [APPLICATION SPEC.] and input this screen.

This information is stored with the weld procedure and is printable with the other procedure data.

If this procedure is used again (possibly by another welder), one can pick-up the boundary information here. This is safe, preserves the memory and avoids depressing effects (if the result was not good). And about quality assurance and documentation (ISO 9000ff) we do not have to comment, do we?

4.5 TEST

If You generated or changed a weld procedure, there could be a mistake somewhere (as always in life)

Test runs (dry and hot) are necessary, possibly several times.

4.5.1 Example

A stainless tube with OD of 60,3 mm and a wall thickness of 2,0 mm is to be welded with a cassette-weldhead.

First, You prepare the weld-head according to it's manual with an identical piece of tube. Adjust the electrode-distance (arc-length) according to 6.7.2.4.

Then You start with the inputs to the system.

4.5.2 Input Pre- and Post-Parameters

Display Text	*Dim*	*Input*	*Explanation*
Tube/pipe O. D.	mm	60	only full mm, round
Weld-head type		<1> <Enter> <Cursor-keys> <Enter>	System displays choice of weld-heads; mark connected weld-head; now, the weld-head is installed;
Start position	deg	none	automatic
Gas prepurge time	sec	30	according to 6.7.2.1;
Gas postpurge time	sec	30	according to 6.7.2.1;
Strike current	A	25	Standard
Final current	A	5	Standard
Motor start delay	sec	3	2,0 X 1,5 according to 6.7.2.1
Final slope time	sec	5	according to 6.7.2.1, standard adjustment, actually unimportant;
Weld-nr.		1	Input <1> then the system counts Your test-welds;

4.5.3 Input Level-Parameter-Screen 1

From the pre- and post- parameter screen You change to the Level-screen by means of <→>.

Display Text	*Dim*	*Input*	*Explanation*
Tube/pipe O.D.	mm	none	Value is taken from pre- and post-parameter-screen automatically;
Start angle	deg	0	
Final angle	deg	365	full circle + 5 ° overlap;
Time	sec	(114,67)	value is calculated automatically after input of final angle; (an advantage for use of a computer)
Slope time	sec	---	no meaning in a one-level-procedure;
High pulse current	A	60	according to 6.7.2.2;
Low pulse current	A	24	according to 6.7.2.2;
High pulse time	sec	0,40	according to 6.7.2.2;
Low pulse time	sec	0,40	according to 6.7.2.2;
HP travel rate.	mm/min	100	Standard for first trial;
LP travel rate.	mm/min	(100)	as HP travel rate; value is taken from HP travel rate automatically, but You can replace;

4.5.4 Tacking

This screen is achieved by means of <←> <←>

Display Text	*Dim*	*Input*	*Explanation*
Number of tacks		4	for larger tubes use more tacks; increase number, if result not good;
Tack current	A	30	according to 6.7.2.3
Tack time	sek	0,80	double of high pulse time;

5 GENERAL INFORMATION

5.1 PARTICULAR USE

The plant is conceived for the connection with orbital-weld-heads and -devices out of the ORBIMATIC delivery program. Thus, fittings or small containers, preferably made of high-grade steels, steel (dependant on the material, wire feed may become necessary), copper and titanium materials (if these are weldable) are welded by a circulation method under use of the tungsten inert gas process (TIG) by means of a direct current arc.

Additionally, also the connection of hand-burners is possible.

5.2 DESCRIPTION OF THE FUNCTION

The weld procedure is determined to a large extent by the kind of the assigned weld-heads. Please regard the concerning operating instructions for this.

This plant supplies the weld-head with welding current and serves the high voltage impulse for ignition of the arc.

The welding control performs in a way, that the welding current can be controlled according to the weld-job in almost any way. When using cassette-weldheads, an automatic tack-function is integrated.

Furthermore, this plant supplies the servo actuator for the turn of the weld-heads and regulates the desired welding speed as well as the servo actuator for the supply of wire, which can be fed synchronously to the high pulse current.

The atmospheric gases are kept away from the arc by means of the welding gas. The quantity of the gas-feed is controlled by the dosing equipment. The timing of the gas-feed is controlled automatically by means of the weld procedures.

Please regard the detailed information about the process under point 6 of this manual.

5.3 UNPERMISSIBLE USE OF THIS SYSTEM

The plant is conceived and built for performance of high-quality weld seams. Other use would be an abuse, which could cause dangers for operators and for others.

Other use of equipment components such as welding power source, drive units and/or control could cause accidents and are therefore forbidden. In particular it is forbidden to use the power source for charging batteries or as starting aid for motor vehicles!

Use of the system is forbidden, if there are combustible or inflammable conditions due to other causes.

In the interest of Your life and health as well as those of Your colleagues, visitors etc. we hereby urgently ask You for conscientous handling Your machine with regard to its purpose as well as the rules for the prevention of accidents.

In this regard, please consider the safety references under 2.2

5.4 REQUIREMENTS FOR THE PLACE OF USE

The concept of the system and it's components assumes whether-protected location and use.

Please regard the restriction on the relative humidity at 90 % at the place of installation.

Locating the system outside is permissible only, if the needs of rain protection and the limitations in humidity and environmental temperature are fulfilled.

Environmental temperature, min.	[°C]	- 10
max.	[°C]	+ 25 (at higher temperatures, the duty-cycles must be reduced)
relative humidity, max.	[%]	90

5.5 SYSTEM DATA

Welding plant, mainly consisting of	welding power supply with arc ignition system, operation panel, weld gas supply, coolant suppy; function- and drive control of weld-heads; connector for the remote control function- and drive control for wire-feeder;

5.5.1 Connecting values

Elektrical supply		3 ~, 400 V, +PE; (other voltages on request)
Line voltage tolerance		+ 10 % - 20 % (Attention for cable-extensions!)
Line frequency	[Hz]	50 - 60
Permanent input-current	[A]	11,5
Permanent input-power	[kVA]	8
Input current, max.	[A]	15,2
Connected power, max.	[kVA]	10,5
Line fuse	[A]	3 x 16, slow characteristics;
Power factor	[cos φ]	0,9 (at 250 A)
Recommended cross-section for cable extensions, min.	[mm²]	2,5

5.5.2 Welding Power Supply

Model		Welding rectifier
Welding current range, stepless	[A]	3 - 250
Nominal current at 100 % Duty-Cycle (DC)	[A]	190
Voltage	[V]	18
Nominal current at 60 % DC	[A]	250
Voltage	[V]	20
Open circuit voltage, max.	[V]	106
Voltage relation		groundfree;
Weld-cable, cross-section	[mm²]	35
Protection type	IP	23
Cooling type		AF
Size: Width, Depth, Height		
without cooling supply	[mm]	520 x 420 x 405
with cooling supply	[mm]	520 x 420 x 530
Weight		
without cooling supply	[kg]	38
with cooling supply	[kg]	47
Arc ignition		integrated ignition voltage generator
Ignition power, max.	[J]	0,9
Ignition voltage, max.	[kV]	9

5.5.3 Drives

5.5.3.1 Weldhead-Drive

Power supply:		
voltage, max.	[VDC]	24
current, max.	[A]	1,0
Control system		speed control with generator feed-back;
Control mode		pulsable according to procedure adjustments;

5.5.3.2 Wire Feed

Power supply:		
voltage, max.		24 VDC
current, max.		1,0 A
Control system		speed-control by IxR;
feed mode		pulsable according to procedure adjustments, feeding useful to high-current-phase

5.5.4 Gas Feed

Permissible weld-gases		Argon, Helium, Hydrogen max. 6 vol. % as additive;
Connection		by permissible hose over pressure regulator only;
Intake pressure, max.	[bar]	10
min	[bar]	3
nominal	[bar]	4
Quantity, min	[l/min]	2,5
max.	[l/min]	18
Prepurge, max.	[sec]	100
Postpurge, max.	[sec]	100

5.5.5 Coolant Supply

Cooling media		line water with glycol-based frost-protection as frost and corrosion protection;
Glycol content, max.	[%]	50
min.	[%]	25
Filling volume	[l]	9
Circulation		by means of integrated pump,
Control		automatically together with gas-feed or temperature dependant;
Pressure, max.	[bar]	3,5 limited by pump characteristics;
Cooling		air, by means of internal cooler;
Level inspection		sight glass on system front;

5.5.6 Weld control / Procedure memory

The controlling of the entire welding procedure and all functional units takes place by means of the control computer of this system.

The memory of this computer is implemented as a semiconductor memory with back-up battery. It can manage (store) between 200 and 500 weld procedures dependent of their size. These procedures contain all relevant data and information to the functions, discribed under point 3 in this manual.

The aforementioned welding procedures are administered under "procedure-names ". For reasons of the identification, procedure-names may not occur more than once.

The internally stored procedures can be supplemented by additional procedures by putting in an external memory module. With the help of these external memory modules the number of managable procedures can be increased almost without limit.

Modification of weld procedures as well as the plant control itself take place in an special memory, called the active procedure. That means, that a weld procedure is generated, changed, tested and used in this memory and then stored with a new procedure name in the internal memory or on an external memory module.

Use of a stored weld procedure can take place after loading from the internal or an external memory into the "active memory". After loading a procedure into the active memory, the orginal procedure is kept, while the procedure is used in the "active memory". The weld procedure in the active memory always gets lost, when another procedure is loaded.

5.5.7 Operation

The system is operated from the operation panel (regard 3).

Optionally, a remote control can be connected. These functions are described under 3.4.

5.5.8 Data-logging/Printer

By means of the integrated printer, the following information can be printed:

- the programmed weld parameters and the devations during the weld
- weld procedures and their environmental conditions

Additionally, the same data can be printed on an external printer.

5.6 GENERATED NOISE LEVEL

The noise level, generated by the plant is below 84 dB (A) with operating coolant circulation. This measurement assumes the area in front of the operation panel in a height of 1,6 m

6 PROCESS DISCRIPTION

6.1 TIG-PROCESS

Welding according to the TIG-Process has been practiced for many years and is known in this working field.

If there are questions about this process, we would hereby like to direct Your attention to the literature about the subject.

6.2 ORBITAL WELDING TECHNIQUE

By this term one understands a performance of (outside)seams at a certain construction unit.

An orbital weld system typically consists of:

- a weld power source with integrated control
- an orbital weldhead, that leads the TIG burner around the workpiece

The orbital weld seam can be subdivided into segments with different process-data. Thus causing different behaviour and enabling the compensation of the increasing heat in the welded workpiece.

The molten pool is periodically reduced to the solidification and minted dependently of the weld-position more or less strongly.

The requirements of orbital weldheads show a large span. This led to the fact, that in the market

- cassette-weldheads
- open-arc-weldheads and
- tube-to-tube-sheet-weldheads

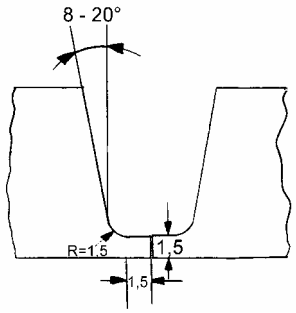
are in use, according to the marked demands and even these are subdivided for different tube diameter ranges.

6.3 WELD SEAM PREPARATION

The most common joining process in the orbital weld engineering is the butt joint, which can be used for wall thickness up to approx. 4 mm.

Unfortunately the TIG weld method reacts on gaps sensitively. For this reason the tube-end-preparation must be prepared with the help of appropriate tools and machines so carefully, that a gap does not exceed the size of 0.1 mm in its widest place.

Anyway, wall thickness of more than approx. 4 mm requires a joint preparation according to Picture 5.



Picture 5 Weld-Preparation

The accuracy requirements for this preparation excludes handheld machines and tools.

In this regard we recommend the use of the ORBIMATIC-tube-facers of the model line X.SQ... or tube saws of the line RA...

In order to keep oxidation of the weld zone within limits, it is proved to be important. that the weld joint preparation should be made directly before the weld is made.

6.4 PERMISSIBLE TOLERANCES

This technique has been developed from the high needs of the properties of such welds.

These needs restrict the acceptability of the different tolerance criteria:

- Gap max. 0,1 mm
- Shift max. 0,1 mm
- Tube/pipe O.D. 0,2 mm
- Tube thickness 0,1 mm

6.5 WELD GAS

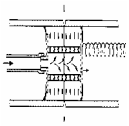
The kind of the weld gas causes considerable influence on the appearance as well as the metallurgical properties of the weld-seam.

For the orbital welding mainly argon is used. Additionally, mixtures are used, which consist of argon with additives of helium and/or hydrogen.

The weld gas is used within the area of the arc on the tubing exterior. As a backup-gas for the weld-root, usually the same gas composition is used inside the tubing.

For larger pipe diameters, it is advisable to use systems for the reduction of the backup-gas-volume.

For optimized leading of the gas inside the tubing and in order to reduce the purge volume we recommend to use commercial backup-gas-inserts. Picture 6 shows the principle function of such a system.



Picture 6 Backup-Gas-Insert

For the protection of the weld-root, please regard the specific requirements.

6.6 WELDHEADS

6.6.1 Open-Arc-Weldhead

Open-arc-weldheads have a (diameter-adjustable) clamping unit for clamping the system onto the fixed workpiece. Another part of the system is the rotation unit, which circulates the electrode around the workpiece by means of a servo actuator.

These weldheads can be equipped with an arc-length-control for process stabilization for use on tubes, that are not round as well as with a wire feed, which can be necessary, when welding normal steels.

With the use of open-arc-weldheads, previous tacking of the welded joint or fixing the second tube-end is necessary.

6.6.2 Cassette Weldhead

At cassette-weldheads, the welding process is performed inside an closed chamber, which is filled with the weld gas. Therefore, no gas-nozzle is necessary and the entire design can be arranged very compactly.

Fixing the pipes can is made by holder inserts in the burner guidance, which must be exchanged for each change of the dimensions. This clamping system leads to a centring of the tube ends, which makes tacking or other adjustments unnecessary. The electrical workpiece-connection takes place automatically over the holder-inserts.

One of the advantages with these weldheads is the insensitivity of the system to annealing colours in the welding zone.

Arc-length-control and wire feed are not possible with this design.

6.6.3 Tube- to Tube-Sheet-Weldhead

With this design the burner axle is aligned parallel to the tube axle. The attachment of the weld-heads takes place at the inside diameter of the tube to be welded. That causes centring of the head at the same time.

The welding gas is led to the arc by a ceramic gasnozzle. A wire feed is optionally applicable.

An arc-length-control is not applicable with this system.

6.7 TYPICAL PROCESS DATA

6.7.1 In General

Those reference values, given below, are to be used as first appoximate values for a first weld-test with an unknown workpiece.

Please note, that the examination of this weld-test must lead to corrections of the weld-data and new weld-tests until the weld-seam quality corresponds to the requirements.

The indicated values refer to high-grade steel, for those in the following specified materials please consider the indicated characteristics:

C-steel	here, the use of wire-feed is recommended
Cu-materials	assuming weldability of the material, we recommend the increase of HP-current of 100%. One more specialty for welding this material is a strong reduction of the arc-current over the weld-time, which makes the installation of more levels (segments) necessary.
Ti- materials	Increase the pre- and post-purge-times;

We need to remind, that the following guide-values are of general nature and that Your available equipment may possibly not permit the welding of all materials and material thicknesses or the use of special weldheads.

With regard to the many conceivable variables which affect a welding result, as machine manufacturers we cannot guarantee a welding result.

6.7.2 Inputs

6.7.2.1 Pre- and Post-Parameter

Function	*Guide-Value*	*Remark*
Gas-prepurge-time for:		
open-arc-weldhead	5 s	too small value causes
cassette-weldhead	30 s	annealing-colours at weld-start;
tube-to-tube-sheet-weldhead	5	
gas postpurge time for:		
open-arc-weldhead	10 s	too small value causes
cassette-weldhead	30 s	annealing-colours;
tube-to-tube-sheet-weldhead	10 s	
Strike current	20 A	Ignition-problems for too small values;
Final current	5 A	weld-end-crater after too high final current;
Motor start delay for:		
WT op to 2 mm	1,5 s /mm wall-thickness	
WT over 2 mm	2,5 s/mm WT	
Final slope time	5 s for tube-Ø < 50 mm 10 s for tube-Ø > 50 mm	Weld-end-crater after too short final-slope-time;
Wire-feed		
Start-delay	value as motor start delay;	
Stop-delay	0 s	too long delay welds the wire;
Wire retract	0,3 s	

6.7.2.2 Level-Parameter-Screen

Function	*Guide-Value*	*Remark*
High pulse current	30 A/mm WT This value is reduced, if the weld-gas has Hydrogen-content: per 2 % H_2 : about 10 %	
Low pulse current	40 % of high pulse current up to 2 mm WT 50 % for stainless, 2 - 3 mm WT 60 % for stainless, WT > 3 mm	
HP-travel-rate (weld-speed)	75 mm/min	related to but-to-but-welding;
Pulse-times high puls time and low puls time equivalent:	1 mm WD: 0,1 s 2 mm WD: 0,2 s 2,5 mm WD:0,25 s 3 mm WD: 0,3 s 4 mm WD: 0,4 s	
Overlap	5 - 20°	dependant on tube diameter, rising value for smaller tube/pipe O.D. To be added onto the final angle!

Wire-Feed		
HP travel-rate	200 mm/min	
LP travel-rate	0	

6.7.2.3 Tack Parameters

Function	*Guide-Value*	*Remark*
Number of tacks	3 - 5	diameter dependant, increase, if still distortion on tube-increase;
Tack-current	50 % of HP-current;	
Tack time	same as motor-start-delay;	

6.7.2.4 APPLICATION SPEC.

Function	*Guide-Value*	*Remark*
Gas quantity, approx.:	7 l/min for open-arc-weldhead; 7 l/min for tube-to tube-sheet-weldhead; 10 l/min for cassette-weldhead;	
Electrode gap, approx.: without wire-feed: with wire-feed:	 0,8 - 1,5 mm 1,5 - 2,5 mm	
Number of weld-layers:		Multilayer from approx. 3,5 mm WT; depending on material and seam-preparation;

7 GUIDE FOR ASSEMBLY, START-UP AND DISASSEMBLY

This guidance assumes, that all actions described in this chapter are performed by particularly trained technical personnel with appropriate knowledge and advise regarding the rules for the prevention of accidents.

7.1 DELIVERY

The plant is delivered complete in a functional condition.

Please take first the small articles out of the packages and examine that they are complete with the help of the packing list.

Inform the responsible safety representative about the arrival of the plant and co-ordinate the transport and set-up with him.

7.2 TRANSPORT OF THE COMPONENTS

For transport, please note, that the equipment is secured against slippage and falling.

7.3 ASSEMBLY

7.3.1 Mechanical

We recommend the assembly on a work-bench. Thus, all sides should be accessible.

7.3.2 Electrical

The plant is delivered for ground-free operation in the welding circuit. That presupposes, that + - cable of the welding power source must be connected with the workpiece before each weld. Exceptionally, only the cassette-weldheads do not need this.

If You should want to use another grounding-system with this plant, we draw Your attention to the associated safety-rules.

The mains connection cable is attached to the supply. First, plug the device plug at the plant and then the line-plug into a slowly-fused, appropriate outlet.

Thus, the assembly is completed.

7.4 DISASSEMBLY

The disassembly of the plant is performed generally in reverse order of the before-described assembly.

7.5 SET-UP

The basic adjustments of the plant are already made with start-up at our works. The plant is thus ready for use.

After connection of a weld-head, please fill first the cooling agent storage tank with the indicated amount of coolant.

Please note, that the cooling agent must be refilled after the first use of a new weld-head (which was empty).

Continue with pos. 2.

7.6 STORAGE OF THE SYSTEM

If the plant should not be needed for a longer time, the disassembly and removal from the place of work are to be recommended.

Before storage (place in a stockroom), we recommend the following procedure:

Clean the plant

Remove all cooling agent. Therefore You disconnect the cooling water return hose of the weld-head and drain the cooling agent supply by means of the pump to a container.

Clean the weld power source with compressed by air inside.

7.6.1 Storage Conditions

Air humidity, rel.	< 70 %
Temperature range	-20 ... +40 °C
	dust-protected