WSI WELD SYSTEMS INTEGRATORS, INC.

RESISTANCE WELDING. SOLVED.

TECNA®

WELDING CONTROL UNIT

INSTRUCTION MANUAL

TE503

RELEASE N° 1.08

EDITION: JUNE 2004

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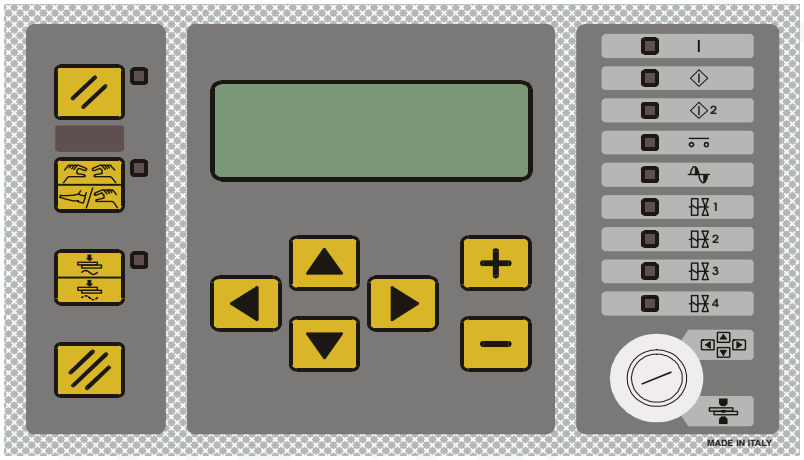
TE503 WELDING CONTROL UNIT

The TE503 is a microprocessor-based welding control unit for three-phase direct current resistance welders. The task of the welding control unit is to manage the welder components, in particular the controlled diodes that carry out the welding current control.
It is possible to store up to 120 different welding programs, 31 of which are recalled directly from an external device. Each program comprises 23 programmable parameters that describe the work cycle. In addition to the plain 4-stage welding cycle, the control unit allows the running of welding processes with pre-welding current, post-welding current, slope and pulses.



MAIN TECHNICAL FEATURES

- Simplified programming via 6 keys and a backlit alphanumeric LCD.
- Synchronous control with controlled diodes, phase control current adjustment
- Storage of 120 welding programs, 31 recallable from the outside
- 23 programmable parameters for each program
- Slope, pulses, pre-weld, post-weld functions and adjustment of the welding times in half-periods.
- Display of the welding current measurement in kA
- Welding current limits.
- Double stroke function
- Stepper function to compensate the electrodes wear with programmable curve
- Counter for the performed welding spots.
- Single and automatic cycle. WELD and NO-WELD function
- Adjustment of first insertion delay
- Control of 4 solenoid valves 24 Vdc max. 5 W with self-protected output
- Autoregulation at mains frequency 50/60 Hz
- Serial data transmission by means of opto-isolated RS232 or RS485 ports.
- Output for optional proportional solenoid valve with dual pressure check.
- Key for selecting foot control or two-hand control.
- Selectable languages: Italian, English, French, German and Spanish.
- Possibility of upgrading control unit Firmware via appropriate software.
- Welding current check for the protection of diodes on the welding transformer.

CONTROL UNIT SWITCH-ON

As soon as the welding control unit is turned on, the display shows the measured mains frequency and the software version of the program.

```
MAINS FREQUENCY
50 Hz
```

```
TECNA TE503 1.08
WELD CONTROL UNIT
```

After a few seconds, the TE503 is set to a waiting condition until the Restart key is pressed

```
009
   PRESS KEY[//]
RESTART TO CONTINUE
```

This key enables the control unit's commands and outputs.
It must be pressed every time the control unit is powered.

When the key is pressed all the devices connected to the VAUX are powered such as for example any double stroke valves.

Before pressing the key it is important to check that it will not cause damage to people or equipment.

Before starting any welding operations, first program the welding data and set some general operating parameters of the welder.

CONTROL UNIT PROGRAMMING

To begin the programming operations, turn the key in the PROG position and be aware of some of the fundamental features of the control unit.

```
   TE503 VER. 1.08
>PROGRAM DATA
 SETUP MENU
 STEPPER MENU
```

The programming parameters of the control unit are divided into different menus as shown in the drawing above:

_ PROGRAMMING
_ CONFIGURATION
_ STEPPER
_ INSTALLATION
_ PROGRAM COPYING
_ INPUT CHECK
_ PROGRAM SEQUENCES

Arrow "**>**" on the left-hand side of the display indicates the cursor's position.
Use keys ⬆ and ⬇ to move the cursor up and down whereas keys ➡ and ⬅ are used for entering and exiting from the menu selected by the cursor.
Use keys ⊞ and ⊟ to set the value of the parameter indicated by the cursor.

PROGRAMMING MENU

The **"Programming"** menu contains all the parameters associated with the welding cycle, the times and the currents by means of which to carry out the welding process.

```
--- PROGRAM DATA ---
>PROGRAM NUMBER  01
 WORKING MODE    FIX
 CONTROL MODE    CUR
```

The first choice to make is the number of the program to be used. Choose among the 120 storable programs using the ⊞ and ⊟ keys.
Then proceed with the next parameters moving with the ⬆ and ⬇ keys, adjusting the desired value always using the ⊞ and ⊟ keys.

As such all the parameters will be set to the desired value for carrying out the welding process. Keep in mind that there is no need to confirm the set data item that is stored automatically after the adjustment. Parameters can have several values, according to the type of parameter. The minimum and maximum limits of each parameter are shown in the following table.

WORK PROGRAM PARAMETERS TABLE

	PARAMETER	DESCRIPTION	VALUE RANGE
	WORKING MODE	WORK MODE	FIX
	CONTROL MODE	CONTROL MODE	NO – CURR
1	SQUEEZE 1	1ST SQUEEZE TIME	01 - 99 cycles
2	SQUEEZE	SQUEEZE TIME	00 - 99 cycles
3	PRESSURE	WELDING PRESSURE	00.5 – 10.0 Bar
4	FORGE DELAY	FORGING TIME	00 - 99 cycles
5	FORGE PRESS	FORGE PRESSURE	00.0 – 10.0 Bar
6	PRE-WELD	PRE-WELD TIME	00.0 - 99.5 cycles
7	PRE-POWER	PRE-WELD CURRENT	05 - 99 %
8	COLD 1	COLD 1 TIME	00 - 50 cycles
9	SLOPE UP	SLOPE UP TIME	00 - 25 cycles
10	WELD 1	WELDING TIME	00.5 - 99.5 cycles
11	POWER 1	WELDING CURRENT	5 - 99 %
12	COLD 2	COLD 2 TIME	01 – 50 cycles
13	N. IMPULSE	NUMBER OF IMPULSES	00 – 09
14	SLOPE DOWN	SLOPE DOWN TIME	00 – 25 cycles
15	COLD 3	COLD 3 TIME	00 – 50 cycles
16	POST-WELD	POST-WELD TIME	00.0 – 99.5 cycles
17	POST-POWER	POST-WELD CURRENT	05 – 99 %
18	HOLD TIME	HOLD TIME	01 – 99 cycles
20	OFF TIME	DWELL TIME	00 – 99 cycles

If CONTROL MODE is activated it will be possible to have additional parameters, namely:

21	CURR MIN	MIN LIMIT IN CURRENT	1.0 – 240.0 kA
22	CURR MAX	MAX. LIMIT IN CURRENT	1.0 – 240.0 kA

if the CONTROL MODE parameter is set to CURR.

There are a few special conditions:

- if OFF TIME is set to 0, the welding control unit will work in single cycle.
- if OFF TIME is set to 99 the welding control unit will carry out the min. current compensation with a value lower than 2.0 kA (see paragraph “Compensation of the secondary current”)
- By setting the PRE-WELD parameter to zero, the pre-weld is not carried out.
- By setting the POST-WELD parameter to zero, the post-weld is not carried out.

DESCRIPTION OF THE PARAMETERS

All the following parameters that indicate times are expressed in periods, also called mains cycles. The mains frequency defines the duration of a period.

Mains frequency of 50 Hz 1 period = 20 ms

Mains frequency of 60 Hz 1 period = 16.6 ms

WORKING MODE

The WORK MODE parameter defines the mode for adjusting the welding current of the program: fixed adjustment (**FIX**).
Welding time WELD 1 is carried out according to the adjustment mode set in this parameter.

CONTROL MODE

The CONTROL MODE parameter permits to select the control mode of the desired welding current.

NO No control is performed on the supplied welding current.
CUR TE503 permits to set the welding current min. and max. limits.
For further information, please read the relevant paragraph.

SQUEEZE 1

The 1st SQUEEZE time or first squeeze determines the time needed by the electrode to move down.
If a pneumatic circuit is present with low-pressure squeeze, such time is that which determines the duration of the squeeze at low pressure, i.e. the interval of time that elapses from the beginning of the head descent to the application of the welding force. The set value must be long enough to allow the electrodes to reach the workpiece to be welded.
In a standard pneumatic circuit, such time is the interval from the beginning of the head descent to the beginning of the welding. The set value must be long enough to allow the electrodes to achieve the proper clamping force, before the welding begins.
During the first squeeze time, it is possible to end the cycle if the start cycle signal is deactivated.

SQUEEZE *Optional*

The SQUEEZE time is a wait time like that of the 1st SQUEEZE. It is necessary for welding machines with low-pressure squeeze functions. In this case, such time determines the interval from the application of the welding force onto the electrodes (energizing of the SV2 valve) to the beginning of the welding. It should be long enough to allow the electrodes to achieve the proper clamping force before the welding begins. An inadequate adjustment of such time produces sparks among the electrodes and the sheet when the welding begins, causing quality inconsistencies. If the welding machine does not contemplate low-pressure squeeze, deactivate this parameter (see Installation Menu). Otherwise it will be added to the 1st squeeze time. If the start cycle signal is deactivated, during the squeeze time, the sequence is interrupted.

PRESSURE *Optional*

This parameter, expressed in bar, expresses the welding pressure value. The set value must be such that it guarantees a proper clamping force during the welding cycle. An inadequate adjustment of such value produces sparks between electrodes and sheet when the welding begins.

FORGE DELAY *Optional*

The FORGE DELAY parameter is used exclusively with pneumatic circuits that contemplate the forging function. Such function permits to increase the electrode force during the welding cycle.
The parameter describes the time that elapses from the beginning of the welding process to the application of the forging force onto the electrodes by means of solenoid valve SV3. If the value is set to zero the forging function is disabled, valve SV3 will be activated at the beginning of the squeezing phase.

FORGE PRESSURE *Optional*

The FORGE PRESSURE parameter is used exclusively with pneumatic circuits that envisage forging and the proportional valve. This function allows to increase the force to the electrodes while welding and to weld at a preset pressure.
The parameter describes the pressure that is applied by the proportional valve during forging. If the forging time value is set to zero, the set pressure will be applied at the beginning of the squeeze.

PRE-WELD

The PRE-WELD parameter indicates the duration of a current flow that can be carried out before the welding process so as to pre-heat the workpiece to be welded. This parameter is expressed by three digits since it can be set with half-period precision. If this parameter is set to 0, the pre-weld will not be carried out. Pre-weld is carried out with a current adjustment equivalent to that indicated in the PRE-POWER parameter (PRE-WELD CURRENT).

PRE-POWER (PRE-WELD CURRENT)

The value expressed in this parameter indicates the power used for carrying out the pre-weld.

COLD 1 (COLD 1 TIME)

The COLD 1 parameter indicates the time that elapses from the pre-weld (PRE-WELD) to the weld (WELD 1).
If the pre-weld is deactivated (that is, when PRE-WELD time = 0), this cooling time is not carried out.

SLOPE UP

The SLOPE UP parameter describes the time for attaining the programmed welding current value. The starting value of this slope always corresponds to the minimum current, whereas the final value corresponds to the current value set at parameter CURRENT 1 (WELDING CURRENT). The slope inclination is automatically calculated by the microprocessor according to the set values. The SLOPE UP time is added to the welding time (WELD 1).

WELD 1 (WELDING TIME)

The WELD 1 parameter indicates the welding current flow duration. It is carried out with the same power value set at parameter CURRENT 1 (WELDING CURRENT).
When the pulse operating mode is activated, this parameter indicates the duration of each pulse. This parameter is expressed by three digits since it can be adjusted with half-period precision.

WELDING POWER

The value indicated in POWER shows the current adjustment used for carrying out the welding process.

N. IMPULSE (NUMBER OF IMPULSES)

The N. IMPULSE parameter indicates the number of impulses used for carrying out the welding process. The duration of each impulse corresponds to the time set in parameter WELD 1 (WELDING TIME).

COLD 2 (COLD 2 TIME)

The COLD 2 parameter is used in the pulse operating mode; it indicates the time that elapses from a welding impulse to the next one.

SLOPE DOWN

The SLOPE DOWN parameter is a welding time that is added at the end of the welding process: it enables to decrease the welding current from the value set at CURRENT 1 down to the minimum value. The slope inclination is automatically calculated by the microprocessor according to the set values. The SLOPE DOWN time is always added to the welding time.

COLD 3 (COLD 3 TIME)

The COLD 3 parameter indicates the time that elapses from the welding process (WELD 1) to the post-weld (POST-WELD).

POST-WELD

The POST-WELD parameter indicates the duration of a current flow that can be carried out after the welding time in order to enable a more gradual cooling of the welded workpiece. This parameter is expressed by three digits since it can be adjusted with half-period precision. If this parameter is set to 0 the post-weld is not carried out. The post-weld is carried out with the current adjustment set in the POST-POWER parameter.

POST-POWER

The value expressed in this parameter indicates the post-welding power.

HOLD TIME

The HOLD parameter indicates the time that elapses from the end of the welding process to the opening of the electrodes. It allows a quicker cooling of the welding spot and prevents the spot from being stimulated before being properly cooled.

OFF TIME (DWELL TIME)

The OFF TIME parameter indicates a welder wait time, namely the one that elapses from one welder cycle to the next one when the welder is working in automatic cycle. When this value is set to zero, the welder always works in single cycle; if it is set to another value, the welder will work in the automatic cycle.
When the welder works in single cycle, the control unit carries out a single welding cycle each time it receives a start cycle signal. When the welder works in automatic cycle, the welder goes on executing welding cycles until the start cycle signal is released.
By programming this parameter to 99 the welding current compensation function is activated (see the relevant paragraph).

CURR MIN (MINIMUM CURRENT LIMIT)

When the control unit is set to current control mode (CONTROL MODE=CUR), this parameter fixes a minimum current value. For each weld, the TE503 monitors that the welding current supplied by the welder is higher than the value set at this parameter; if it is lower, an error message will be displayed (see the relevant paragraph).

If the CONTROL MODE parameter is set to NO (no control on the welding current), the parameter is not displayed during the programming phase.

CURR MAX. (MAXIMUM CURRENT LIMIT)

When the control unit is set to current control mode (CONTROL MODE=CUR), this parameter fixes a maximum current value. For each weld, the TE503 monitors that the welding current supplied by the welder is lower than the value set in this parameter; if it is higher, an error message will be displayed (see the relevant paragraph).

If the CONTROL MODE parameter is set to NO (no control on the welding current), the parameter is not displayed during the programming phase.

CONFIGURATION MENU

The **"Configuration"** menu contains those parameters that are used for enabling or disabling a function of the control unit.

```
 ---CONFIGURATION---
>START CYCLE1   10
 START CYCLE2   06
 SPOTS PRINT   OFF
```

CONFIGURATION MENU PARAMETERS TABLE

PARAMETER	DESCRIPTION	VALUE RANGE
START1 PRG	Start cycle 1 program	00 – 120
START2 PRG	Start cycle 2 program	01 – 120
PRINTER SPOT	Welding spots print	ALL – GOOD – BAD
STOP BAD SPOT	Number of spots for out-of-limit stop	0-9
PROG SEQUENCE	Program sequence activation	ON – OFF
AMMETER CAP.	Ammeter capacity	56 – 127 kA
CALIBRATION	Self-calibration procedure	OFF
LANGUAGE	Language for describing parameters	ITA-ENG-ESP-DEU-FRA

START CYCLE 1
This parameter indicates the program number to be run when the cycle is activated from the start cycle 1 command. The value of the program also includes 0 which, if set, allows the control unit to work with the program that is active in the setting.

START CYCLE 2
This parameter indicates the program number to be run when the cycle is activated from the start cycle 2 command.

SPOTS PRINT
With this parameter, if the serial port is setup for print (see "Installation" paragraph), the user can choose which welding spots to be printed. It is possible to print all spots or only the spots whose current value remains within the set limits or those with out-of-limits values.
In the ALL SPOTS print mode, the control unit highlights the spots whose current value remains outside the set limits and prints in red on those printers that are set up for this function.

OUT-OF-LIMITS BLOCK SPOTS FUNCTION

Parameter BLOCK SPOTS allows to program the control unit so that it stops when welding spots are performed that have current values outside the limits set in the welding program. The set value indicates the number of consecutive "out-of-limits" welding spots that cause the machine to stop. The limit error occurs when a welding spot is carried out with values either higher or lower than the limits set in parameters CURR MIN and CURR MAX. To set the value use keys [+] and [−] the value can be set from 0 to 9.
If the value is set to zero, this function is deactivated; in this case, the welder does not stop even in case of "out-of-limits" welding spots.

PROGRAM SEQUENCE
The sequence type operation is activated with this parameter. If this parameter is set to ON, the menu for setting the program sequences will appear in the list of the main menus.

AMMETER CAPACITY
This parameter indicates the ammeter capacity of the control unit. Keep in mind that the capacity refers to simple harmonic currents and as such overflow conditions might occur even with effective current values lower than the nominal value of the carrying capacity and this depends on the sensitiveness of the connected transducer.

CALIBRATION
This parameter cannot be modified and its standard value is OFF.

LANGUAGE
With this parameter the user programs the language in which the control unit should display both the parameters to be set and the error messages.

STEPPER MENU

The "**Stepper**" menu contains parameters associated with the current stepper operations.

```
--- STEPPER ---
>NUM. INCREMENTS 01
 SPOTS 1        4000
 INCREMENT 1    12%
```

STEPPER MENU PARAMETERS TABLE

PARAMETER	DESCRIPTION	VALUE RANGE
TOTAL STEPS	Number of incremental steps	01 – 07
SPOTS 1	Spots step 1	0 - 10000
INCREMENT 1 %	Percent increment step 1	0 - 50
SPOTS 2	Spots step 2	0 - 5000
INCREMENT 2 %	Percent increment step 2	0 - 50
SPOTS 3	Spots step 3	0 - 5000
INCREMENT 3 %	Percent increment step 3	0 - 50
SPOTS 4	Spots step 4	0 - 5000
INCREMENT 4 %	Percent increment step 4	0 - 50
SPOTS 5	Spots step 5	0 - 5000
INCREMENT 5 %	Percent increment step 5	0 - 50
SPOTS 6	Spots step 6	0 - 5000
INCREMENT 6 %	Percent increment step 6	0 - 50
SPOTS 7	Spots step 7	0 - 5000
INCREMENT 7 %	Percent increment step 7	0 - 50

NUM. OF INCREMENTS

This parameter indicates how many segments are to be created for implementing the stepper curve. Only the parameters that describe the desired function will be displayed in relation to the set value.

SPOTS 1,2,3,...

Each of these parameters indicates the number of spots of which the associated segment is composed.

INCREMENT 1,2,3,...

These parameters indicate the current stepper percent to be attained upon the completing of the spots set in the associated segment.

CURRENT STEPPER FUNCTION

The stepper function enables to compensate the wear of the electrodes that affects the quality of the welding spots. When the electrode diameter is enlarged, the contact section area between the electrode and the workpiece to be welded increases and, as a consequence, the welding current density (Ampere/mm^2) decreases. If the current is maintained at a fixed value throughout the whole electrode life, it will be noticed that the quality of the last spots is poorer than the first ones. The stepper function is used for overcoming this problem. It gradually increases the current adjustment during the welding process when the diameter of the electrodes increases: this enables to maintain a constant current density.
An increment curve is programmed to describe the pattern of the current during the electrodes' life. This curve is described by one or more segments for each of which the number of welding spots and the associated current increment in percent are programmed.

After it has been set, the current increment is applied to all the welding programs used.

The current or conduction angle limits, if used, increment by the same percent. The same holds true for the pre-weld and post-weld current adjustments.

If the set welding power values are changed during the process, the control unit takes them into consideration and re-calculates the welding conditions.

If modifications are made to the programmed stepper curve, the control unit clears the counter and therefore the starting diameter of the electrodes must be reset.

SIMPLIFIED USE OF THE STEPPER FUNCTION (LINEAR INCREMENT)

The stepper function can be used in a simplified manner by programming a simple percent increment for a specific number of welding spots that are to be carried out with the same electrodes.
The user must know the service life of the electrodes in order to adjust these parameters. To do this run some welding tests with new electrodes before they are replaced. Under these two conditions the currents, required for carrying out the welding spots of the required quality, are assessed. The change in percent is calculated and then it is set in the control unit.

The parameters that allow the carrying out of the stepper function are entered in the "**Stepper**" menu. The instructions for programming these parameters are outlined in the relevant paragraph.

For the "simplified" use of the stepper function, always set parameter STEPS INCREM to 1 (since the segment to be programmed is only one). Enter the number of welding spots to be carried out in parameter SPOTS 1, i.e. the foreseen life span of the electrodes. Enter the percent increment to be achieved in parameter INCREMENT 1.

Example:

After having run the welding tests, the result was that the usable life of the electrodes = 2000 welding spots. Another fact that ensued was that the required current for new electrodes = 15 kA, whereas after 2000 welding spots the diameter increase of the electrodes requires a current of 19 kA.

Therefore calculate the change in percent as follows:

$$Change\ \% = \frac{endcurrent - initialcurrent}{initialcurrent} \times 100 = \frac{19-15}{15} \times 100 = 26\%$$

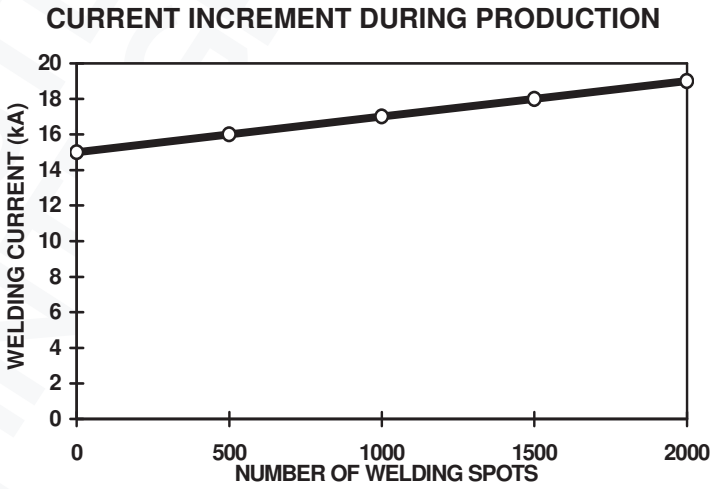
Consequently the following parameters are set in the "**Stepper**" menu:

PARAMETER	DESCRIPTION	VALUE
STEPS INCREM	Number of segments for stepper function	1
SPOTS 1	First segment spots number	2000
INCREMENT1	First segment increment percent	26%

The welding program should be adjusted for carrying out the first welding spot followed by the adjustment that permits to obtain the required current with the starting electrode diameter: 15 kA. It does not matter whether the TE503 is programmed for a percent adjustment or a constant current adjustment since the stepper function is operational in both modes.

Now the welding process can begin. Current will vary conforming to the set increment rule. The graph below shows its pattern.

INITIAL CURRENT = 15 kA
END CURRENT = 19 kA
INCREMENT PERCENT = 26 %
NUMBER OF WELDING SPOTS = 2000



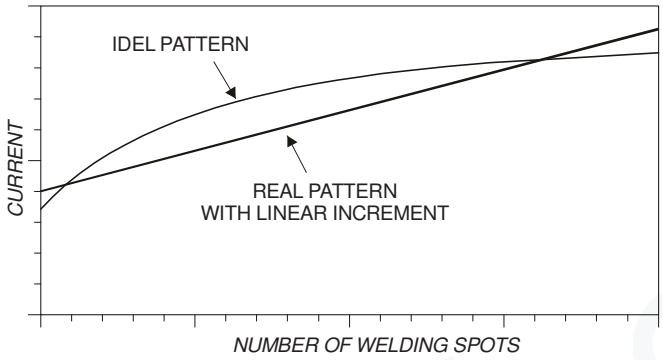
Upon having completed all 2000 welding spots the TE503 stops the production cycle and displays the following message:

```
22
   ------STOP------
 MAX. N. of SPOTS
```

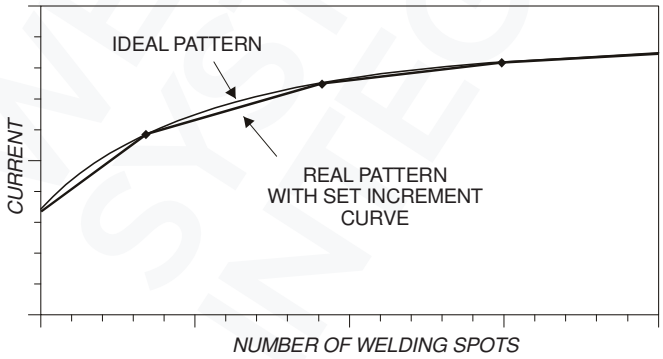
At this point the operator replaces the electrodes (or resets their original diameter) and clears the spots counter to clear stepper calculations. The TE503 resets the initial work parameters and begins a new increment phase.

COMPLETE USE (NON-LINEAR INCREMENT CURVE)

In the aforesaid work method, a linear welding current increment is used during the whole life span of the electrodes. In actual fact the increase of the contact section of the electrode on the sheet is not linear but has a pattern that is similar to the one shown in the graph below.



As such the use of the linear increment is an approximation which nonetheless permits to achieve good results in most applications. However when the user wishes to achieve utmost constancy during work conditions, a non-linear increment curve can be set that is described by defining a certain number of segments.
This type of adjustment requires an adequate knowledge on how electrodes wear and on the parameters required during their life. Consequently many welding spot tests are necessary for assessing the work conditions in different moments of the electrodes' life.



The increment curve is set by assessing a certain number of linear segments. The number of welding spots and the desired increment are assessed for each segment.
The STEPS INCREM parameter determines the number of segments to be inserted in the increment curve. Enter the number of welding spots that make up the segment in the "SPOTS n" parameters. Enter the corresponding percent increment to be achieved in the "INCREMENT n" parameter.
The programming procedure is outlined in the "**Stepper**" menu paragraph.

Example:

After a number of welding tests, the ensuing life of the electrodes resulted to be 4000 welding spots and the following current values are required during the different moments of the electrodes' life.

SPOTS PERFORMED	REQUIRED CURRENT
0 (initial electrode diameter)	15 kA
700	17.8 kA
1800	19.5 kA
3000	20.2 kA
4000 (end electrode diameter)	20.7 kA

Therefore calculate the duration (in number of welding spots) and the percent increment of each segment.
Keep in mind that the percent increment must always be calculated in relation to the beginning of the segment being examined.

$$\text{Duration of segment } 1 = 700 - 0 = 700 \text{ spots}$$
$$\text{Duration of segment } 2 = 1800 - 700 = 1100 \text{ spots}$$
$$\text{Duration of segment } 3 = 3000 - 1800 = 1200 \text{ spots}$$
$$\text{Duration of segment } 4 = 4000 - 3000 = 1000 \text{ spots}$$

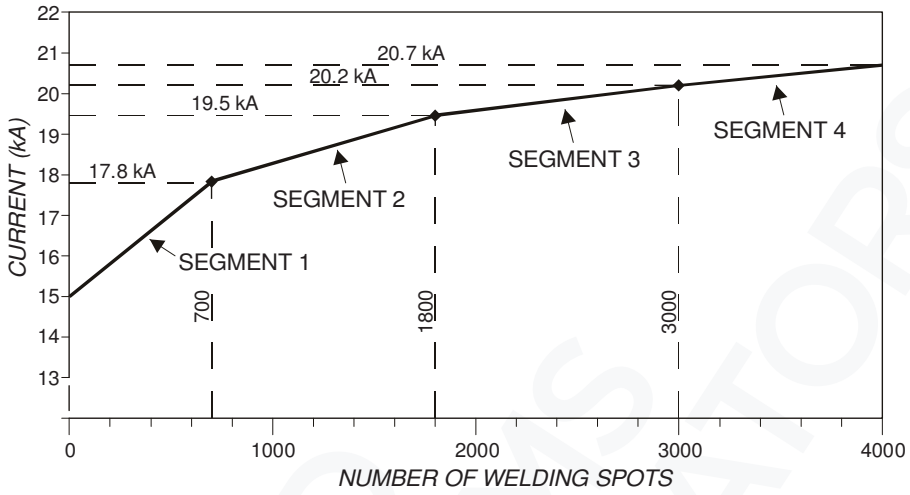
$$Change\ \%\ segment\ 1 = \frac{endcurrent - initialcurrent}{initialcurrent} \times 100 = \frac{17.8 - 15}{15} \times 100 = 19\%$$
$$Change\ \%\ segment\ 2 = \frac{endcurrent - initialcurrent}{initialcurrent} \times 100 = \frac{19.5 - 17.8}{17.8} \times 100 = 10\%$$
$$Change\ \%\ segment\ 3 = \frac{endcurrent - initialcurrent}{initialcurrent} \times 100 = \frac{20.2 - 19.5}{19.5} \times 100 = 4\%$$
$$Change\ \%\ segment\ 4 = \frac{enecurrent - initialcurrent}{initialcurrent} \times 100 = \frac{20.8 - 20.2}{20.2} \times 100 = 3\%$$

The following parameters are consequently set in the "**Stepper**" menu:

PARAMETER	DESCRIPTION	VALUE
TOTAL STEPS	Number of segments per stepper function	4
SPOTS 1	Number of spots of the first segment	700
INCREMENT1	Increment percent of first segment	19%
SPOTS 2	Number of spots of the second segment	1100
INCREMENT2	Increment percent of second segment	10%
SPOTS 3	Number of spots of the third segment	1200
INCREMENT3	Increment percent of third segment	4%
SPOTS 4	Number of spots of the fourth segment	1000
INCREMENT4	Increment percent of fourth segment	3%

The welding program should be adjusted for carrying out the first welding spot followed by the adjustment that allows the achieving of the required current with the starting diameter of the electrodes: 15 kA.

Now the welding process can begin. Current will change according to the programmed increment rule. The graph below shows its pattern.



INSTALLATION MENU

The installation menu contains the parameters that describe the complexity and typology of the welder on which the control unit works. Due to their importance, access to this menu is protected by a code.

```
035
  ENTER ACCESS CODE
       * * * *
```

If the user is not authorized to enter this menu and does not know the access code, the following message is displayed:

```
036
  ACCESS CODE ERROR
   ACCESS DENIED !!
```

The parameters can be edited only after having typed in the access code.

Keep in mind that only skilled personnel are permitted to edit the following parameters to prevent damage to people or equipment.

PARAMETER	DESCRIPTION	VALUE RANGE
FIRST INSERT.	1st Insertion delay	01 –99
SERIAL COM.	Serial communication	PRT/232 – NET/485 - NONE
NETWORK ADDRESS	Network address	01 - 32
COIL RATIO	Rogowski ratio	X1 –X5 – X10 – X0.5
LOCK/END OUT	Output function	END – LOCK
FUNCTION RIC.	Recall function 5	RIC5 – ODD – EVEN
LOW FORCE SQ.	Low force squeeze	ON – OFF
FORGE	Forging	ON – OFF
PROPORT. VALVE	Proportional valve	ON – OFF
PRESSURE RATIO	Pressure transducer for proportional	0.1 – 2.0
DIODE PROTECTION	Factor for diode protection	001 – 240

FIRST INSERTION DELAY FUNCTION

The FIRST INSERTION parameter shows the first insertion delay. This function permits to optimize the balance of the mains consumption of the welder. After having selected this parameter, the value can be adjusted from 1 to 99 with keys ⊞ and ⊟ . For more information refer to the specific chapter.

SERIAL COMM.
The user may choose whether to activate the serial data transmission port and how it is to be used, connect a printer (PRT/232) or connect the control unit to a data supervision network (NET/485), or not use this option (NONE).

NETWORK ADDRESS
This parameter indicates the identifying address of the control unit when connected in the network, activating the aforesaid option.

COIL RATIO
This parameter shows the sensitivity of the current transducer installed on the welder.

OPTIONS	SIGNAL RATIO	AMMETER CAPACITY
X1	150 mV / kA	56 – 127 kA
X5	750 mV / kA	11 – 25 kA
X10	1,5 V / kA	5 – 12 kA
X0.5	75 mV / kA	110 – 250 kA

LOCK/END OUT
This parameter indicates, interlock (LOCK) or cycle end (END), the activation time of the corresponding output.

RECALL 5 FUNCTION
This parameter indicates the function associated to the Recall 5 input.
_ Input for the direct recalling of the work program up to 31 (REC 5).
_ EVEN parity test input for the other recalls.
_ ODD parity test input for the other recalls.

LOW FORCE SQUEEZE
This parameter is activated for welders that envisage the low-pressure squeeze function. Its enabling adds the Squeeze parameter to the welding program.

FORGE FUNCTION
This parameter is used for enabling the forging for pneumatic circuit welders that envisage this function. Its enabling adds the Forge Delay parameter to the work program.
If this parameter is activated together with the PROPORTIONAL VALVE parameter, the Forge Pressure parameter is also added to the work program.

PROPORTIONAL VALVE
This parameter is used for welders that envisage the use of a proportional valve and the parameter that is activated in the program is the Pressure parameter.
If this parameter is activated together with the FORGE parameter, the Forge Pressure parameter is also added to the work program.

PRESSURE TRANSDUCER
With this parameter it is possible to select, if the above parameter is activated, the most suitable BAR/VOLT ratio for the type of solenoid valve the user intends using.

DIODE PROTECTION
This function serves to check the current value of the machine output according to the welding time. It serves to prevent the diodes on the transformer from burning due to too much current or too long a conduction time.
This information represents a factor with which the limits are calculated. To set this information, it is necessary to know the number of diodes on the welding transformer and then multiply it by 10.

PROGRAM COPY MENU

The **"Program copy"** menu is used for copying the values of the parameters of a program to other programs without having to set one parameter at a time.

```
-- PROGRAMS COPY--
>SOURCE PROGRAM   03
 FROM PROGRAM     06
 TO PROGRAM       10
```

PROGRAM COPY MENU PARAMETERS TABLE

PARAMETER	DESCRIPTION	VALUE RANGE
SOURCE PROGRAM	Source program	01 – 120
FROM PROGRAM	Program start copy/target	01 – 120
TO PROGRAM	Copy end program	00 – 120

SOURCE PROGRAM
This program indicates the number of the program to be copied to other programs. The value of this parameter may vary from 01 to 120.

COPY FROM PROGRAM
This program indicates the first program into which the source program is copied in the case of a multi-program copying operation. If it concerns an individual copying, it represents the target program to which the source program is to be copied. The value of this parameter may vary from 01 to 120.

TO PROGRAM
This program indicates the last program into which to copy the source program. The value of this parameter may vary from 00 to 120. Programmed value 00 indicates that the source program will be copied to the target program only.

To copy programs access the copy menu from the main menu using key ➡, set the desired values in the aforesaid parameters and then press key ⬅.

Now the confirmation message of the copying action is displayed:

```
COPY PROGRAM  <03>
 FROM <06> TO <10> ?
  PRESS KEY[+]=OK
 ▮▮▮▮▮▮▮▮▮▮▮
```

Press key ➕ to copy, conforming to the parameters displayed in the video page shown above. The operation is completed when the last line of the display is filled and the control unit shows the main programming video page. If any other key is pressed or if you wait a few seconds, the operation will not be carried out and the main programming video page is returned to.

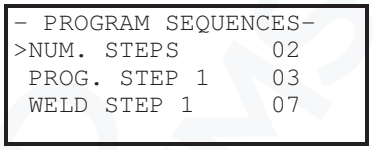
PROGRAM SEQUENCE MENU

This menu includes the parameters required for activating the program sequence operations. In this work mode the weld control unit commands the welder to perform a series of spots, deciding automatically the work program for each spot and the spots order without having to make an external selection of the program.

This menu is not always active in the main programming menu. It is activated by setting the parameter of the **Setup** to **ON.**

PROG SEQUENCE	Program sequence activation	**ON**

When this menu is activated it can be accessed with key ➡ and the parameters shown in the figure can be set.



PROGRAM SEQUENCE MENU PARAMETERS TABLE

PARAMETER	DESCRIPTION	VALUE RANGE
NUMBER SEQUENZ.	Number of sequences	01 – 05
STEP 1 PRG.	Program of step 1	01 – 120
STEP 1 WELDS	Number of welds with step 2	00 – 20
STEP 2 PRG.	Program of step 2	01 – 120
STEP 2 WELDS	Number of welds with step 1	00 – 20
STEP 3 PRG.	Program of step 3	01 – 120
STEP 3 WELDS	Number of welds with step 3	00 – 20
STEP 4 PRG.	Program of step 4	01 – 120
STEP 4 WELDS	Number of welds with step 4	00 – 20
STEP 5 PRG.	Program of step 5	01 – 120
STEP 5 WELDS	Number of welds with step 5	00 – 20

N. STEPS
The value of this parameter indicates the number of steps, i.e. the number of spot sequences with different work programs.

STEP PROG. 1,2,3,…
This program indicates the program number that the welder must carry out and is matched to the associated step number.

WELDS STEP 1,2,3,...
The value of this parameter indicates the number of welds to be carried out with the program matched to the same step.

After having activated this mode and having set the parameters of the "**Program sequences**" menu as described above, the welding spots can be started. With the key in RUN position, the display shows the sequence data as shown in the figure below.

```
WELD  008  OF  013
STEP  03  OF  04
PROG. 03  RMS 10.45
NEXT WELD  009
```

Information on the display indicates the following:

- Line 1. The succeeding number of the last weld performed and the total number of welds of which this sequence is composed.
- Line 2. The number of the step with which the last weld was performed and the total number of steps.
- Line 3. The program number and the RMS current value of the last weld.
- Line 4. The progressive number of the next weld.

SEQUENCE EXAMPLE

Let's take for example the sequence operation after having set the following values in the parameters.

PARAMETER	VALUE
NUMBER SEQUENCE	04
STEP 1 PRG.	03
STEP 1 WELDS	04
STEP 2 PRG.	07
STEP 2 WELDS	02
STEP 3 PRG.	11
STEP 3 WELDS	06
STEP 4 PRG.	04
STEP 4 WELDS	01

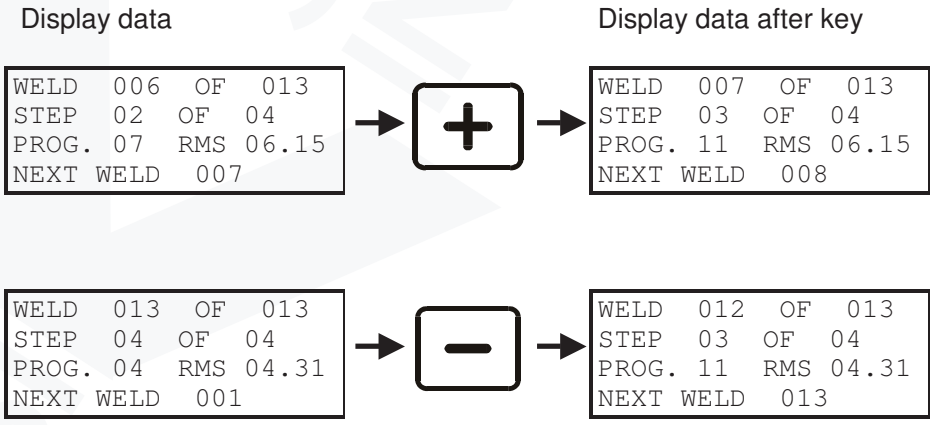
For each start cycle signal a spot is carried out with the weld program associated with the current step.
In this specific case, as shown in the chart below, the following welds are performed in sequence:

- 4 welds with program 03
- 2 welds with program 07
- 6 welds with program 11
- 1 weld with program 04

WELD	1	2	3	4	5	6	7	8	9	10	11	12	13
STEP	1	1	1	1	2	2	3	3	3	3	3	3	4
PROG	03	03	03	03	07	07	11	11	11	11	11	11	04

Usually this type of operation is applied to one manual welder where the operator always performs weld spots in the same order but with different work parameters. By means of this system the operator does not need to change the program manually which would cause his/her attention to be distracted from the workpiece to be welded or does not have to change pedal or other start cycle device.
However the operator must pay utmost attention during the process not to perform fewer spots than those programmed, overlapping spots or not in the same order.

In any case if a sequence process error is made, it is possible to repeat the last weld or another weld, or continue by avoiding some spots. Always with the key in RUN position, use keys [+] to increase the welds counter to the next spot or to the desired spot. Use key [−] to go back one or more positions of the spots to be carried out.



CHECK INPUT MENU

This menu displays the status of the welding control unit inputs. It is activated with the key in PROG position and is used for checking the efficiency and proper operation of the external devices, connected to the control unit, required for using the welder.

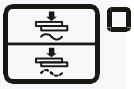
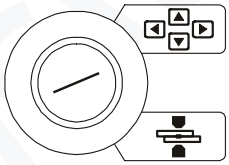
```
-- CHECK INPUT --
>START N.O.      OFF
 START N.C.       ON
 START2 N.O.     OFF
```

All the inputs available at the connectors of the control unit are included in the list that is scrolled with keys ⬆ and ⬇. The status of the inputs is shown as active (Input closed with COM1) with wording ON; not active with wording OFF.

PANEL LEDs

☐ I	The turning on of this LED indicates that the welder control unit is powered.
☐ ◇	If this LED is switched on it indicates that start cycle 1 command is activated.
☐ ◇ 2	If this LED is switched on it indicates that start cycle 2 command is activated.
☐ ⎓	The turning on of this LED indicates that the pressure-only stopping command is activated.
☐	The turning on of this LED indicates that the control unit is producing the command impulses for the SCR.
☐ 1	It indicates that the solenoid valve 1, which carries out the main cycle, is activated.
☐ 2	It indicates that the solenoid valve, which controls back pressure, is activated.
☐ 3	It indicates that the solenoid valve, which carries out the pressure or forging cycle, is activated.
☐ 4	It indicates that the solenoid valve, which controls the double stroke, is activated.

COMMANDS ON THE PANEL

	Left-hand direction key used for exiting from the programming menus.
	Right-hand direction key used for entering the programming menus.
	Upward direction key used for moving the cursor inside the upper parameter.
	Downward direction key used for moving the cursor inside the lower parameter.
	This key is used for increasing the value of a numeric parameter or for changing the status of a parameter.
	This key is used for decreasing the value of a numeric parameter or for changing the status of a parameter.
	 RESTART key. It enables the commands and the control unit's outputs. **It must be pressed every time the control unit is powered**. When this key is pressed, all the devices connected to VAUX are powered such as for example any double stroke valves. **Before pressing the key it is important to check that it will not cause damage to people or equipment.**
	Key for selecting the start cycle device: PEDAL or TWO HANDS-CONTROL. When the nearby LED is switched off, the start cycle command is carried out by the PEDAL whereas if the LED is switched on, the command is carried out by two-hand push buttons (TWO HANDS-CONTROL). In order to work properly, the two push buttons must be pressed at the same time or in sequence within a maximum time of 0.5 seconds conforming to the accident prevention regulations.
	WELD-NO WELD Key. In WELD position (LED switched on) the control unit runs the programmed welding cycle. In NO-WELD position (LED switched off), the control unit runs the programmed cycle without welding current circulation keeping all the time parameters unchanged.
	CLEAR Key. It is used to clear the error conditions and to set to zero the welding counter.
	PROG-RUN Key selector. In PROG position it enables the keyboard and allows the running of all the foreseen programming operations. In RUN START position it enables the spot welder commands and allows the running of the work program only.

SELECTION OF THE WORK PROGRAM

The table below shows which inputs are to be activated to recall the work program directly. The selection is made by means of five inputs, appropriately activated according to the combinations shown below.

PROG. N.	REC1	REC2	REC3	REC4	REC5	REC5 EVEN	REC5 ODD
1	•					•	
2		•				•	
3	•	•					•
4			•			•	
5	•		•				•
6		•	•				•
7	•	•	•			•	
8				•		•	
9	•			•			•
10		•		•			•
11	•	•		•		•	
12			•	•			•
13	•		•	•		•	
14		•	•	•		•	
15	•	•	•	•			•
16					•		
17	•				•		
18		•			•		
19	•	•			•		
20			•		•		
21	•		•		•		
22		•	•		•		
23	•	•	•		•		
24				•	•		
25	•			•	•		
26		•		•	•		
27	•	•		•	•		
28			•	•	•		
29	•		•	•	•		
30		•	•	•	•		
31	•	•	•	•	•		

• = input active

The programs that can be selected are 31, when using input REC5 as additional recall input, or 15 if using input REC5 as parity check. The use of input REC5 as parity check is activated in the "**Installation**" Menu (see specific paragraph) in which the type of parity is also selected: Even or Odd. The parity check consists in checking that the number of activated inputs, for recalling a program, is even or odd.

Example.
Recall of Prog. N. 06 with even parity check.
To recall program 6 you must activate two inputs, REC2 and REC3, but since parity is odd you must also activate input REC5 to obtain an odd number of active inputs.

To properly recall the welding programs, either activate the direct recall inputs before the start cycle signal or simultaneously.

WORK MODES

The TE503 weld control unit permits to perform welds with different welding current supply and check methods. The table below shows the different modes, the operations required for activating them and the compatible functions.

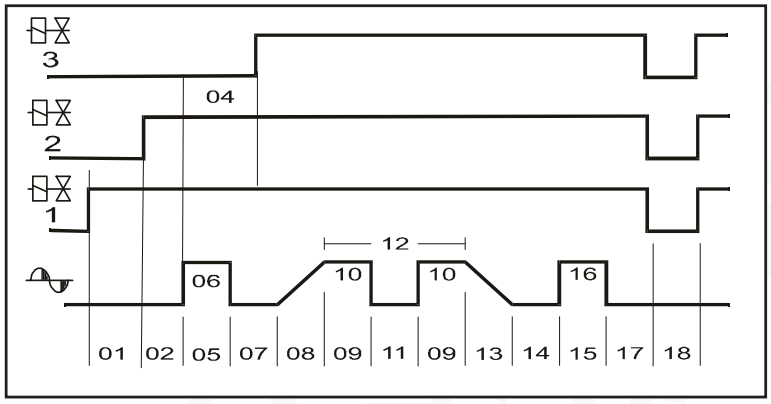
	FIX
Self-calibration procedure	**x**
Rogowski ring sensor	**x**
Stepper function	NO
Program sequence function	YES
CUR control mode	YES
DEG control mode	YES
Current compensation	YES
Welding analysis	YES
Proportional valve	YES
Rogowski ratio	All
Automatic mains compensation	NO
First insertion delay	**.**
Ammeter capacity	All

X= not compulsory
· = compulsory

DESCRIPTION OF THE WORK CYCLE

The TE503 work cycle is set by the user by adjusting the programming parameters. These parameters indicate the operating times and the current adjustments characterizing the work cycle when carried out consecutively.

The following chart shows the sequence in which the programmed functions are carried out.



The aforesaid numbers refer to the programming parameters described in the "**Programming**" Menu paragraph.

For safety reasons, the microprocessor does not start the welding cycle if the start cycle device is activated when switching on the welder; release it and restart it.
Any microinterruptions or excessive voltage drops will stop the control unit and do not alter the operation; to reset the operation, turn the machine off and then turn it on again.

READING OF THE WELDING CURRENT

After every welding operation, the display shows the following information:

- The welding program used.
- The number of the welding spots carried out as of the last counter reset.
- The set welding time.
- The value of the current of the last welding spot.

```
PROG. 01  SPOT 12340
 WELD CYCLE 01.0
 CURRENT     43.26
CONDUCTION DEG 000°
```

The value of the current, which the control unit measures and which is displayed, stands for the average of the values measured for every welding time half-period. The displayed value always refers to the main adjustment i.e. to that of the WELD 1 parameter. For pulse welding spots the value of the current will always be the average value of all the impulses.

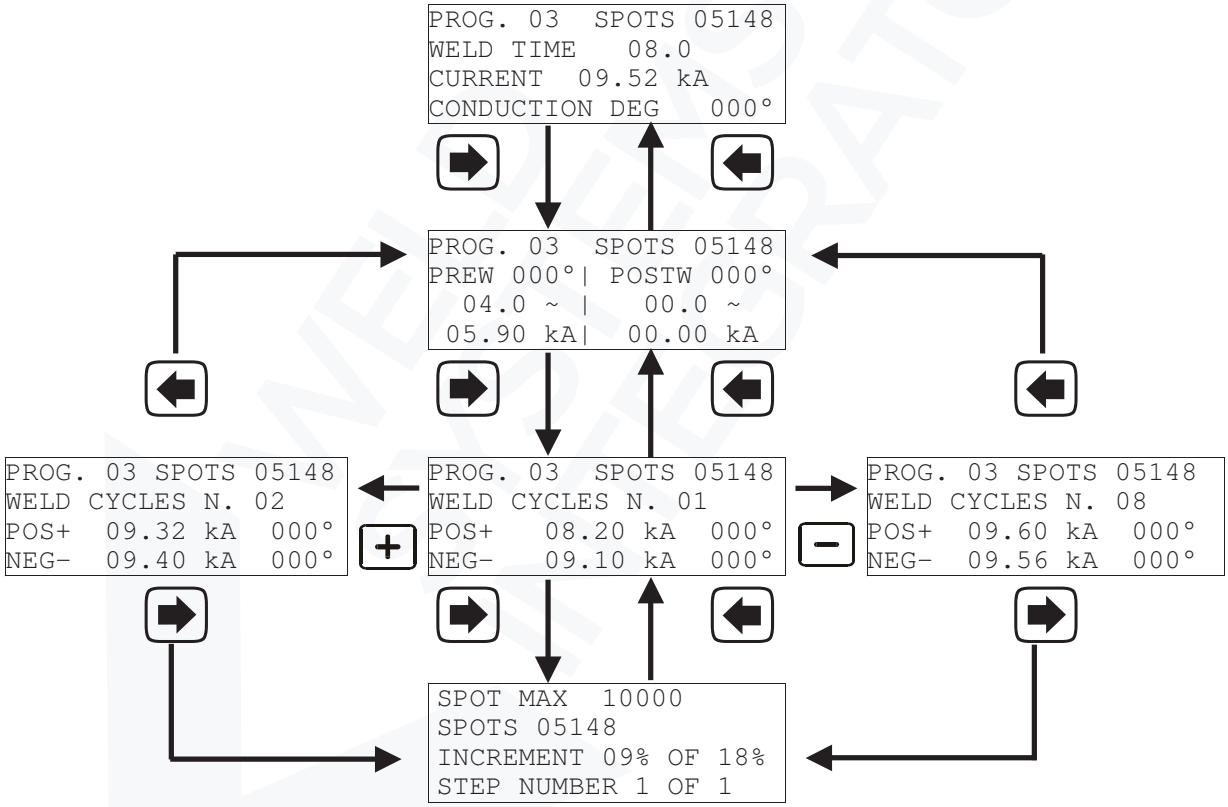
WELDING ANALYSIS

The welding pattern can be analyzed exhaustively by means of the welding check. It is possible to view in detail the current values and the conduction degrees, read at each half-cycle of the main WELD1, the values of any pre-welds and post-welds, and (if activated) the progress status of the stepper function.

To access these functions turn the key to RUN position, perform a weld and press key ➡ to display the first data video page. Then you may continue in the succeeding video pages as shown below.

Welding example with these parameters:

- Pre-Weld Time 4 cycles
- WELD1 Time 8 cycles
- Post-Weld Time 0 cycles
- Incremental step 1 (10000 spots / 18 %)



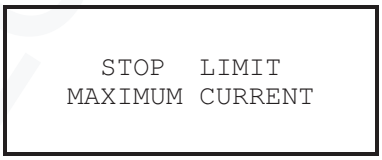
WELDING CURRENT LIMITS

TE503 allows the user to set some welding current control limits. The purpose is to monitor the stability of the welding current so as to achieve a constant welding quality.
The control unit enables the user to select two different control modes:

Welding current limits

To activate this control mode, set parameter CONTROL MODE to CUR.
Two new parameters will be displayed:
CURR MIN minimum current limit
CURR MAX. maximum current limit
These two parameters enable to set the welding current limit-values.

When working, if the measured value of the welding current is beyond the set limits, the welding spot is considered “out-of-limit".
If consecutive “out-of-limits” welding spots occur, it is possible to stop the welder. The number of the consecutive welding spots, that stop the control unit, can be set by means of the BLOCK SPOTS parameter in the setup menu (see the relevant paragraph for the programming operations). This value varies from 0 to 15. By setting it to 0, this function is disabled, so that the welding process is not stopped in case of “out-of-limits” welding spots.
Bear in mind that in order to be effectively considered and counted, the “out-of-limits” welding spots must come after one another.
When the set error condition takes place, the control unit stops and the display shows an error message. The error message refers to the last welding spot. When working with the current control mode (CONTROL MODE=CUR), if the last welding spot current is either lower or higher than the limits set in the aforesaid parameters, the display will show one of the following messages:



COMPENSATION OF THE SECONDARY CURRENT

The secondary current compensation function is used for facilitating the welding process of oxidized sheets and rods. The oxidation of the workpieces blocks the current flow during the first welding phase, thus limiting, in a different way depending on the type of welding process, the real current flow time. The compensation function controls the welding current, until the current exceeds a pre-set threshold equal to 2000 A. The welding time is automatically extended up to a limit of 99 periods. In this way it is possible to carry out welding processes with a constant real current flow time. Keep in mind that this function should be used only in the event of welding conditions that cannot be overcome otherwise, since it is not a system that assures welding quality.

This function is activated by setting the OFF TIME parameter value to 99; when this function is active, the control unit works in single cycle. In constant current operating mode, this function is deactivated.

WELDING SPOTS COUNTER FUNCTION

The control unit contains a weld counter with the possibility of programming the maximum number of welding spots. During the welding process, the control unit displays the value currently attained by the counter. The counter is updated after each welding spot, with the only exception of welding tests carried out in NO WELD.
To clear the counter press, in RUN mode, the CLEAR key. The display will show the following message:

```
RESET COUNTER
SPOTS?  [-]=YES
```

Press the MINUS (-) key to clear the counter otherwise wait 8 seconds to end the procedure without clearing the counter.
The maximum welds number is set by following the same procedure described for the stepper function.
For example, if you want to carry out 2840 welding spots without using the stepper function, set the following parameters in the setup menu:

PARAMETER	DESCRIPTION	VALUE
STEPS INCREM	Number of segments for stepper function	1
SPOTS 1	First segment spots number	2840
INCREMENT1	First segment increment percent	0%

When setting these parameters, the counter is automatically cleared.
When the counter attains the set number of welds, the control unit displays the following message:

```
-----STOP-----
N. MAX SPOTS
```

Welder operations are interrupted until the counter is cleared. If SPOTS 1 parameter is set to zero, the stop function is deactivated.

SERIAL INTERFACE RS-232 ITEM 50214 (Option)

Use expansion card ITEM 50214 to connect the TE500 with a printer or a PC fitted with RS232 serial interface to document production data.
The card interfaces with the control unit by means of a 6-pin connector and with the printer (or computer) by means of a standard female 9-pole connector. The 9-pole connector is wired as follows:

PIN 1	CD (ALWAYS ON)
PIN 2	TRANSMISSION (TD)
PIN 3	RECEPTION (RD)
PIN 4	DTR (ALWAYS ON)
PIN 5	MASS (GROUND SIGNAL)
PIN 6	DSR (ALWAYS ON)
PIN 7	RTS
PIN 8	CTS
PIN 9	NOT CONNECTED

On request, cable Art. 70377 is available for the connection with standard serial printers that as a rule are equipped with a female 25-pole connector as follows:

PIN1	GROUND (GROUND FRAME)
PIN2	TRANSMISSION (TD)
PIN3	RECEPTION (RD)
PIN 4	TRANSMISSION REQUEST (RTS)
PIN 5	READY AT START (CTS)
PIN 6	DATA READY (DSR)
PIN 7	MASS (GROUND SIGNAL)
PIN 20	TERMINAL READY (DTR)

The control unit does not execute any type of handshaking at the serial port. The serial port of the printer must be configured with the following values:

SPEED	9600 BAUD
WORD LENGTH	7 BIT
PARITY	EVEN
STOP BIT	1

The control unit runs the data transmission at the beginning of the OFF time. Keep in mind that the time used for printing data is approximately 20 ms and such time will be added to the set OFF time.
A specific parameter in the special functions menu permits to choose whether or not to activate the print. The following items are printed for each weld:
Welding program number
Number of cycles with which the weld was carried out
Welding current
Welding current conduction angle
Progressive spot number
Out-of-limit spot signal

When the control unit is powered, every time a programming value is edited and when the key selector is switched from PROGRAM to RUN the control unit prints the header and the values of the parameters of the selected program.

Data printout example during the weld:

```
PROG CYCLES CURRENT DEGREE SPOTS  LIMIT
 01   10,0   06.0    061   00001
 01   10,0   06.0    061   00002
 01   10,0   06.0    061   00003
 01   10,0   06.0    061   00004
```

Data printout example during the weld in CUR Control Mode:

```
PROG CYCLES CURRENT DEGREE SPOTS  LIMIT
 01   10,0   06.0    062   00009 CUR OK
 01   10,0   06.0    062   00010 CUR OK
 01   10,0   06.0    062   00012 CUR MIN
 01   10,0   06.0    062   00013 CUR MIN
 01   10,0   06.0    062   00014 CUR MAX
 01   10,0   06.0    062   00015 CUR MAX
 01   10,0   06.0    062   00016 CUR MAX
```

(Current value lower than MIN limit)

(Current value higher than MAX limit)

Printout example of work program parameter values:

```
CONTROL UNIT TE503
PROGRAM NUMBER  01
WORKING MODE   FIX
CONTROL MODE   NO
SQUEEZE 1       20 ~
SQUEEZE         20 ~
FORGE DELAY     10 ~
PRE-WELD      00.0~
PRE-POWER       05 %
COLD 1          00 ~
SLOPE UP        00 ~
WELD          10.0 ~
CURRENT         50 %
COLD 2          00 ~
IMPULSE N.       1
SLOPE DOWN      00 ~
COLD 3          00 ~
POST-WELD     00.0 ~
POST-POWER      05 %
HOLD TIME       20 ~
OFF TIME        20 ~
```

SERIAL INTERFACE RS-485 ITEM 50209 (Option)

The RS-485 serial expansion card (option) permits the control unit to be networked with other welding control units and with a central PC for programming the control unit or for documenting production data. The card interfaces with the control unit by means of a 6-pin connector and with the external network by means of a standard male 9-pin connector with the following signals:

CONNECTIONS OF CONNECTOR DB9	
1	Ground
2	Y
3	A
4	R1A
5	R2A
6	Z
7	B
8	R1B
9	R2B

The card can be connected only when the control unit is not powered. It is also advisable to first connect the 6-pin wire, which connects the weld control unit, and then make the RS485 connection. At this point the control unit can be powered and the **NET/485** function can be activated in the "**Installation**" menu.
In the network communication an identifying address must be assigned to the weld control unit (slave) so that it can be recognized by a Master, for instance a Personal Computer. This parameter, called **NETWORK ADDRESS** is set in the "**Installation**" menu.
A PC software program, called **TECNANet**, is available for handling data and communication among the networked control units for checking the network's structure, i.e. how many and which control units are connected, for carrying out (for each control unit) all the programming functions remotely, and for acquiring and storing production data.

TECHNICAL RECOMMENDATIONS

The interface is isolated up to 1500V, without the need for any external power supply, and works connected to standard RS485 signals in half duplex or full duplex mode. The male 9-pin connector has two screws with thread 4-40 UNC with threaded head. These screws are to be used for wall mounting purposes (max. 3mm) and for locking the mobile connector.
The 50209 card is fitted with a black protective cover for protecting it against dust and electrostatic charges. It is advisable to always keep it on the connector when the interface is not used.

Some terminating resistances are present on the cards which should be connected only at the first and last network connector. Furthermore it is essential that the ground be connected among all the devices connected to the network.
The connection cable between the devices must not be longer than 1200m. It must be shielded and have metallic or metallized connection connectors such as Belden 8777 cable at 24 AWG.

INTERFACE FOR PROPORTIONAL VALVE ITEM 50220 (Option)

Interface card ITEM 50220 permits the control unit to control a proportional valve and to set, as program parameter, the welding pressure in bars. This interface requires an external power supply. The 12-pin terminal strip permits the connection of the proportional valve, the control unit and the interface power supply.

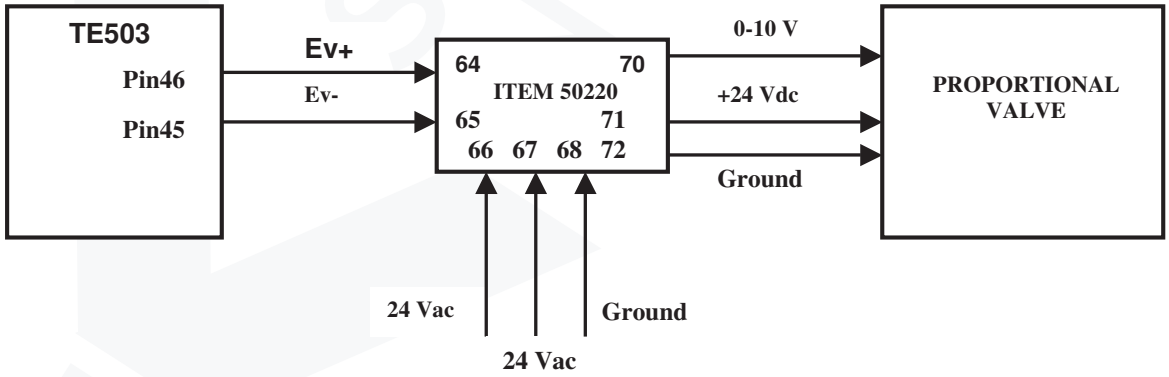
TERMINAL STRIP CONNECTIONS	
64	**SV+ from the control unit (PIN 46)**
65	**SV- from the control unit (PIN 45)**
66	**24Vac**
67	**24Vac**
68	**Ground**
69	**OUT-I**
70	**0-10Vdc to the proportional SV**
71	**+24Vdc to the proportional SV**
72	**Ground to the proportional SV**
73	**ALARM-IN**
74	**ALARM1 (PIN 33- AUX3)**
75	**ALARM2 (PIN 34- COM1)**

It is possible to program the control voltage range of the proportional valve directly form the weld control unit. The **PRESSURE TRANSDUCER** parameter is in the "**Installation**" menu by means of which it is possible to select the **bar/Volt** ratio most suitable for the type of solenoid valve to be used.

Example.

Pressure Parameter bar	Pressure Transducer Parameter bar/Volt	Output Volt
5.0	1.0	5
5.0	2.0	10
5.0	0.5	2.5

WIRING DIAGRAM



N.B.

_ A red D10 LED is present on card 50220 (near the relay) for indicating when +24VDC (Pin 71) is present and which goes to the proportional valve. If the LED is OFF check for the correct 24VAC wiring (Pin66 and Pin67) and ground wiring (Pin68);

_ Card 50220 also contains a small trimmer for regulating the voltage output full scale (Pin70). This regulation is performed when the required tests are run and therefore MUST NOT be shifted from its default position so that the value at output will always be exact.

INTERFACING WITH AUTOMATIC SYSTEMS

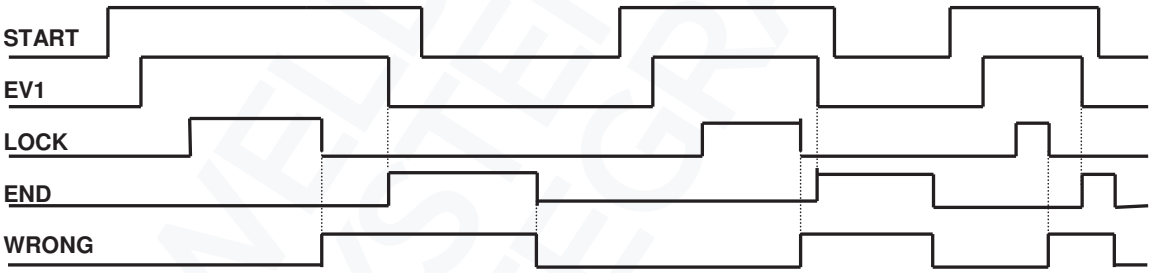
The TE503 weld control unit can be used in an automated welding system by exploiting a few signal inputs and outputs, the activation of which identifies a precise welding process moment.

Inputs.

- Start. Start cycle command. To perform the weld it must be kept active at least until the LOCK contact is activated.
- Aux. This input locks the cycle in pressure only. If activated, it locks the welder with electrodes in closed status during one of the squeeze times.

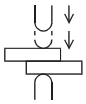
Outputs.

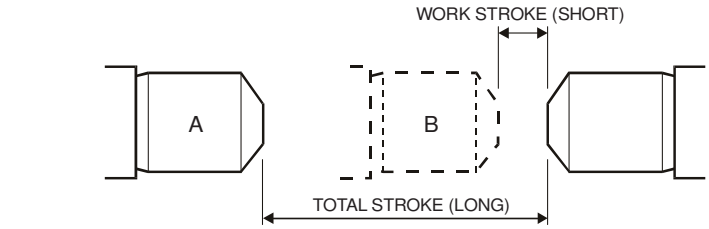
- SV1. Main solenoid valve output. It is activated after the Start and is deactivated at the end of the HOLD TIME.
- Wrong. Error signal for limits or power failure. Active for HOLD and PAUSE.
- Lock. This output signals the beginning and the end of the current circulation during the cycle.
- End cycle. This output signals the end of the cycle of one weld, for the pause time. During the single cycle the signal closes at the end of the Hold time and reopens on issuing the cycle-start signal. If the cycle-start signal had already been deactivated, the contact remains closed for 2 cycles (40ms). If the control unit is used in automatic cycle mode (OFF pause time other than 0) the cycle will stay closed for the entire OFF time.



DOUBLE STROKE FUNCTION

The output of the control unit called SV4 controls the double stroke solenoid valve. When the machine is powered, it is always disabled even if the D_STROKE input is active and the electrode is in position “A”. The control unit sets it to position “B” when the first weld is performed as shown in the figure below.





A - POSITION OF THE MOBILE ELECTRODE WITH DOUBLE STROKE DEACTIVATED (LONG STROKE)
B - POSITION OF THE MOBILE ELECTRODE WITH DOUBLE STROKE ACTIVATED(SHORT STROKE)

During this first weld the TE503 activates solenoid valve SV4 (that shifts the electrode from position “A” to position “B”), waits a fixed time of 0.6 seconds and performs the programmed weld cycle. At the end of the weld, solenoid valve SV4 is not deactivated and the electrode remains in position "B". The succeeding welds will be performed starting from this position. When input D_STROKE is activated, solenoid valve SV4 is kept activated and the electrode, in rest status, will be in position “B”. Should the operator need to open the electrodes during the process, deactivate the input to trigger the deactivation of solenoid valve SV4.

DESCRIPTION OF SIGNALS ON TERMINAL BOARD

NAME	MEANING	CONNECTOR
VAC	This is the control unit's power supply, which must be 24 Vac. The power supply transformer should be at least 50 VA and must supply the control unit only, in order to avoid possible sources of interference.	1 3
GND	Ground connection.	2
LOCK- / END- LOCK+ / END+	This output is a polarized opto-electronic switch Max. 30 V/ 10 mA, and is used for signaling when a cycle ends if END CYCLE is selected; when LOCK in selected, the control unit gives an output signal from the beginning of the welding process to the hold.	4 5
WRONG- WRONG+	This output is a polarized opto-electronic switch Max. 30 V/ 10 mA, that closes if the set current limits are not respected. The contact remains closed for the HOLD and OFF time. A max. voltage of 24Vdc and a maximum current of 0.1A can be applied to this contact.	6 7
COM2 TRIGGER	Output of the trigger signal for the SCRs. Output is an impulse train with a 5 KHz frequency, duty cycle of 16-20%, 30V amplitude on a load of 35 Ω. It is necessary to use the TECNA firing modules.	9 10
COM1 RIC5/PARITY	This input, closed on COM1, can have two functions depending on the choice made in the setup menu. The first function is external recall, the second function is to control the parity during the recall.	11 12
RIC4 RIC3 RIC2 RIC1	These inputs are used to directly recall the welding program from an external device. For a correct recall of the programs, these inputs should be enabled before the start cycle signal. The inputs are active when closed on the shared COM1.	13 14 15 16
COM1 START2_NO	Connect to the microswitches of the start cycle pedal. START2 determines the beginning of the work cycle of the second program chosen during the programming operations. This input is active when closed on the shared COM1.	17 19
AUX2	This input allows an external device to stop the welding cycle during the squeeze phase. It can be used as an interlocking input or for connecting safety devices such as for instance flow regulators or pressure switches. The contact connected to it should be the normally open type and is activated when closed on COM1.	18
START2_NC	Not used.	20

COM1 START_NO	Connect to the microswitches of the start cycle pedal. The START determines the beginning of the work cycle. This input is active when closed on the shared COM1.	21 23
AUX	This input allows an external device to stop the welding cycle during the squeeze phase. It can be used as an interlocking input or for connecting safety devices such as for instance flow regulators or pressure switches. The contact connected to it should be the normally open type and is activated when closed on COM1.	22
START_NC	Not used.	24
BIC1_NO	This input can be connected to the hand-operated start cycle push buttons. The welding cycle starts when BIC1_NO and BIC2_NO are closed simultaneously or closed in sequence within a maximum time of 0.5 secs. This value has been chosen in accordance to the international safety rules.	25
BIC1_NC COM1	Not used.	26 29
D_STROKE COM1	This input is used for the manual control of the double stroke in welders fit with this function.	27 29
BIC2_NC COM1	Not used.	28 29
TERM FLUX/TERM COM1	This input can be used for connecting a thermostat (pin 30-32). If a flow regulator is also present, the input must be connected in series with the thermostat, i.e. the thermostat with pin 30-31 and the flow regulator with pin 31-32.	30 31 32
AUX3 COM1	This input allows an external device to stop the welding cycle during the squeeze phase. It can be used as an interlocking input or for connecting safety devices such as for instance flow regulators or pressure switches. The contact connected to it should be the normally open type and is activated when closed on COM1.	33 34
BIC2_NO	Input for the hand-operated start cycle push buttons. The welding cycle starts when BIC1_NO and BIC2_NO are closed simultaneously or closed in sequence within a maximum time of 0.5 secs.	35
VAUX	24 Vdc output. It indicates that the control unit is powered and ready to receive a start cycle command. This output can be used to connect a valve for the opening of the cooling circuit. This is a suitable command for piloting a 24Vdc coil max. 5 W.	37
EV1 COM2	Connect to the solenoid valve that actuates the main cycle. This is a suitable command for piloting a 24Vdc coil max. 5 W.	38 39
EV2 COM2	Connect to solenoid valve 2 (BACK PRESSURE). This is a suitable command for piloting a 24Vdc coil max. 5 W.	40 41

EV3 COM2 EV4	Connect to solenoid valve 3 (FORGING) and 4 (DOUBLE STROKE). This is a suitable command for piloting a 24Vdc coil max. 5 W.	42 43 44
EV PROP- EV PROP+	This is an output that is connected to the piloting card of the proportional solenoid valve. Option art. 50193.	45 46
EMERGENZA EMERGENZA	Emergency input. An emergency button can be connected to these inputs, the contacts of which should open if faults occur. The emergency procedure and consequently the opening of these inputs cut voltage to all the outputs.	47 48
ROG AGND	The current transducer (Rogowski ring) must be connected to this analog input.	49 50
SHIELD	Shield for transducer cable.	51

NOTE.

The component indicated with acronym "**F3**", located on the connector side of the control unit, is a delayed fuse, non-resettable, which supports a max. current of 3.5 A. If the ON LED does not light up, check the status of the aforesaid component.

TE503 MESSAGES LIST Ver. 1.08

MESSAGE	N°	CAUSE	REMEDY
MAINS FREQUENCY 50 HZ	1	The control unit measured a mains frequency of 50 Hz.	
MAINS FREQUENCY 60 HZ	2	The control unit measured a mains frequency of 60 Hz.	
MAINS FREQUENCY ERROR	3	The control unit was not able to measure a steady mains frequency.	Try to turn on the control unit again and ensure that power supply is 24 V AC with 50/60 Hz frequency.
STORING OF DEFAULT VALUES	4	The control unit is entering default values in its program storage.	
PRESS KEY [+] TO ZERO DATA	5	The control unit's data zeroing procedure has been activated.	Press key [+] to continue otherwise press any other key or wait a few seconds.
DATA ZEROING IN PROGRESS	6	The data zeroing procedure of the control unit is in progress.	
SOFTWARE UPGRADE IN PROGRESS	7	The upgrade procedure of the control unit is in progress.	
PRESS REARM KEY [//] TO PROCEED	9	The control unit is waiting for the rearm key to be pressed so as to activate the welding control unit functions.	Ensure that the activation of the VAUX does not cause damage to equipment and/or people, then press the key.
ERROR – MAINS SYNCHRONISM	10	A synchronism error has occurred due to the temporary lack of the reference signal of the power supply line or due to line interferences.	Clear the error by pressing any key. If the error occurs frequently, check the working efficiency of the devices that cut the power supply line and check for any interference.
TECNA TE503 VER. 1.08 WELDING CONTROL UNIT	11	When the control unit is turned on it displays the type of control unit and the software version.	
THERMOSTAT ACTIVATED	18	The protection thermostat inside the welder has been activated.	Check that water is flowing inside the welder in the necessary quantity and / or check the working efficiency of the thermostat.
SOLENOID VALVES OVERHEATING	19	The short circuit safety device of the control unit outputs has tripped.	Check the electric wiring of the control unit. Check the coil of the solenoid valve.

ALARM CURRENT ERROR	20	During the welding process an error occurred during the current measurement procedure.	The control unit cannot measure the welding current properly. Contact the customer service.
-----STOP----- MAX. SPOTS N.	22	The welds counter has attained the maximum set value.	Clear the counter, see chapter “FUNCTION OF THE WELDS COUNTER”
STOP MINIMUM CURRENT LIMIT	23	The control unit counts some faulty spots, the last of which has been carried out with a current value lower than the min. set limit.	Clear the error by pressing any key. See chapter “CURRENT LIMITS”
CURRENT LIMITS > MAX. CURRENT	25	The set value in one of the current limits (parameters 17-18) is higher than the max. current value of the welder.	Set the current limits to a lower value than the max. current value of the welder.
MIN. CURRENT > MAX. CURRENT	26	The set value in MIN. CURR. (17) is higher than the set value in MAX CURR (18).	Set the min. current limit to a lower value than the max. current limit.
STOP MAXIMUM CURRENT LIMIT	28	The control unit counts some faulty spots, the last of which has been carried out with a current value higher than the max. set limit.	Clear the error by pressing any key. See chapter “CURRENT LIMITS”
NO CURRENT SIGNAL	31	During the last welding cycle there was no secondary current circulation in the machine.	Check for continuity of the secondary circuit. Check the electric wiring of the current transducer.
CHANGE AMMETER CAPACITY	32	The welding process is being performed in constant current or with a power percentage using an ammeter capacity different from the one set in the self-learning procedure.	Change the ammeter capacity or change the program parameter to select a different work mode.
NO EMERGENCY SIGNAL	33	The emergency signal, required for operating the control unit, is missing.	Ensure that the emergency contact is closed.
ZERO SPOTS COUNTER? KEY[-] =YES	34	The CLEAR key was pressed to zero the number of spots and the control unit requests confirmation.	Press the key [-] to clear the spots counter, otherwise press any other keys or wait a few seconds.
ACCESS CODE * * * *	35	Someone is trying to access the menu restricted to installers.	Enter the access code if known. Otherwise wait a few seconds.
CODE ERROR NO ENTRY	36	Someone is attempting to enter the installers-only menu without knowing the access password.	
PULSES > MAX. WELDING TIME	37	The total pulse welding time is higher than the maximum value of 125 periods.	Decrease the pulse welding time or the number of impulses.

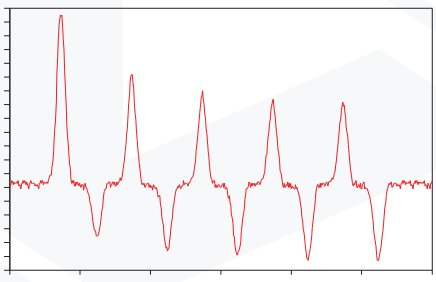
PRESSURE xx.x Bar	38	The measured and displayed welding pressure is not within the limits set in the execution program.	Check the air feed circuit or change the pressure limits in the program.
ERROR!! SAFETY RELAY	39	The safety relay that supplies the control unit's outputs is faulty.	
STEPPER FUNCTION NOT ACTIVE	40	The stepper function is not active and therefore any data entered in the associated menu have not been accepted.	In order to activate the stepper function, check the set data and make sure that there are no inconsistencies.
DIODE PROTECTION ERROR	41	The output current is too high or the welding time is too long for the number of diodes on the transformer	Reduce the current or the welding time.

FIRST INSERTION DELAY ADJUSTMENT

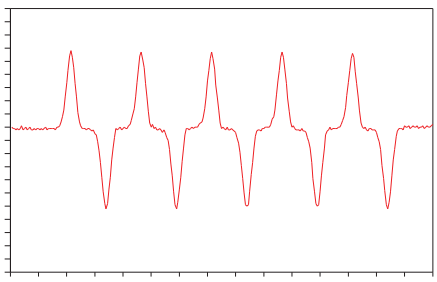
During the installation phase, the first insertion delay is to be adjusted. This adjustment allows the optimizing of the welder's line consumption balance. Adjust by setting the control unit to maximum power (CURRENT 1 = 99%) and carry out "loadless" welding spots, interrupting the secondary circuit (e.g. by placing non-conducting material in between the electrodes). Adjust the " FIRST DELAY" parameter (see the "INSTALLATION" paragraph) so that positive and negative line consumptions are balanced. It is possible to use two different solutions for measuring the primary current:

Use an ammeter capable of measuring positive and negative maximum peak values (such as the TECNA TE1430). In this manner the adjustment will be correct when the positive peak value will be similar to the negative one. The value of the current consumed by the welder (when loadless) might be too low for the instrument's minimum capacity. Solve this problem by running the cable, on which the measurement is being taken, inside the current sensor several times. In this case the read value will be multiplied by the same number of cable-run-through operations performed in the sensor.

Use an ammeter that allows the displaying of the wave forms on a digital oscilloscope. In this case perform the adjustment so that all the half waves of the primary current have the same amplitude. The graphs below show the wave forms achieved both with an incorrect and a correct adjustment.



Unbalanced consumption



Balanced consumption

NOTES

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