WSI WELD SYSTEMS INTEGRATORS, INC.

RESISTANCE WELDING. SOLVED.

TECNA®

WELDING CONTROL UNIT

INSTRUCTION MANUAL

TE553

FROM SOFTWARE RELEASE N° 1.50

EDITION: MARCH 2013

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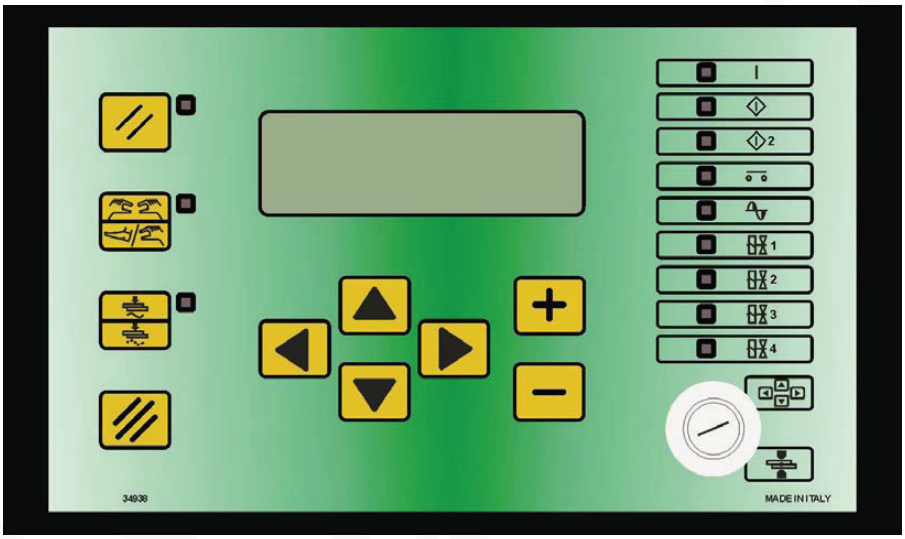
CHAPTER 1 - TE553 WELDING CONTROL UNIT DESCRIPTION

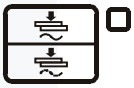
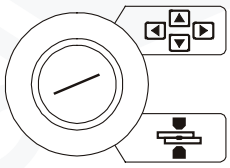
The TE553 is a microprocessor-based welding control unit for resistance welders. The task of the welding control unit is to manage the welder components, in particular the controlled diodes that carry out the welding current adjustment.
The TE553 is a particularly versatile welding control unit as it may be adjusted to different types of welders; it may be installed not only on spot and projection welders but on seam welders too. It may work with power adjustment and in constant energy (optional). The number of inputs and outputs may be increased so to better adjust the welding control unit to automatic machines.
It is possible to store up to 250 different welding programs, 31 of which are recalled directly from an external device. Each program comprises several 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.



1.1 - MAIN FEATURES

- Simplified programming via 6 keys and a backlit alphanumeric LCD.
- Synchronous controlled diodes command, adjustment of the phase control current.
- Welding current check for the protection of diodes on the welding transformer.
- Storage of 250 welding programs, 31 recallable from the outside
- Up to 23 programmable parameters for each program.
- Slope, pulses, pre-weld, post-weld functions and adjustment of the welding times in half-cycles.
- Display of the RMS weld current in kA.
- 2 operating modes: conventional and constant energy (optional).
- Welding current limits, on the material thickness as well as on its indentation (optional).
- Double stroke function.
- Stepper function to balance the electrodes wear-out with adjustable curve.
- Single and automatic cycle. WELD and NO WELD function.
- Adjustment of the first insertion delay.
- Control of 5 solenoid valves 24 VDC max. 5 W with self-protected output.
- Self-adjustment to the mains frequency 50/60 Hz.
- Serial communication via RS232 or RS485, insulated optional.
- Output for proportional solenoid valve.
- Button for Foot Pedal or Two-Hand Control selection.
- Selectable languages: Italian, English, French, German, Spanish, Hungarian, Swedish, Portuguese or Polish.
- Possibility of upgrading control unit Firmware via appropriate software.
- Activation and control of the electrodes dressing (optional).

1.2 - PANEL CONTROLS

	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. **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-HAND 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 the two-hand push buttons (TWO-HAND 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.
	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 weld counter.
	PROG-RUN Key selector. In PROG position it enables the keyboard and allows the running of all the foreseen programming operations. In WORK position it enables the spot welder commands and allows the running of the work program only.

1.3 - PANEL LEDs

☐ I	The turning on of this LED indicates that the welder control unit is powered.
☐ ◇1	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 by means of the AUX1 and AUX2 inlets 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 executing the main cycle is activated.
☐ 2	It indicates that the solenoid valve, which controls the back pressure, is activated.
☐ 3	It indicates that the solenoid valve, which enables the forging, is activated.
☐ 4	It indicates that the solenoid valve driving the double stroke is activated.

1.4 - DESCRIPTION OF DISPLAYED INFORMATION

Some pieces of information are displayed on the main frame following each weld sequence; this is done both for the cycles carried out in WELD mode and for the ones in NO WELD mode. **The values displayed in the following description are representative only.**

```
PROG. 001 SPOT 12340
 WELD TIME  10.0 ~
RMS 032.6kA
```

In WORK configuration, the displayed descriptions are always in English regardless of the selected language in the **SETUP MENU.**

PROG. 001
It indicates the program used for the last weld sequence; it may be a number between 001 and 250. It is displayed both in WELD and in NO WELD mode.

SPOT 12340
It stands for the welded spots counter; it may be a number between 00000 and 65000. It is updated in WELD mode only and it may be cleared by means of the CLEAR key.

WELD TIME 10.0 ~
It indicates the welding time used for the last weld sequence. Its value is included between 00.5 and 99.5. The same value is displayed both in WELD and in NO WELD mode.

CURRENT RMS 032.6 kA
It indicates the current value used for the last weld sequence. In WELD mode it may have a value between **000.0** kA and **126.0** kA. In NO WELD mode its value is 000.0 kA. It represents the average of the RMS values measured for each welding time half-cycle. The value shown always refers to the WELD current parameter. In case of pulse welds, the current value would always be the average value of all the pulses.

When the control unit is equipped with the supplementary expansion board item 50200, the displayed working frame is as follows:

```
PROG. 001 SPOT 12340
 WELD TIME  10.0 ~
RMS 032.6kA
ENERGY 01351 joule
```

Where, to the above described information, is added:

ENERGY 01351 joule
It indicates the total energy value used for the last weld sequence.

Before switching on the TE553 control unit with the supplementary expansion board item 50200, check that the inlet ELECTRODES END LIFE CLEAR (Pin 52) is not activated.
Otherwise, the 50200 board is not recognized by the control unit.

From the main displayed working frame

```
PROG. 001 SPOT 12340
 WELD TIME  10.0 ~
CURRENT RMS 032.6 kA
```

Other information may be displayed: for instance, about the welds carried out, the stepper function status and the last 20 displayed errors.

In order to access the weld analysis function for the different run semi-periods, press key ▶ once.

```
PRG 001  SPOT 12340
 WELD TIME 01 ~
POS+ 032.6 kA
NEG- 032.6 kA
```

PRG 001
It indicates the program number used for carrying the last weld sequence.

SPOT 12340
It indicates the welded spot number being analyzed. It always stands for the last weld sequence.

WELD TIME 01 ~
It indicates the cycle of the whole welding time relevant to the welding being analyzed.

POS+ 032.6 kA
Indicates the value of the current, expressed in kA, of the positive semi-period of the affected weld cycle.

POS- 032.6 kA
Indicates the value of the current, expressed in kA, of the negative semi-period of the affected weld cycle.

By means of the keys + and −, it is possible to check the other cycles of the analyzed welding.

```
PRG 001  SPOT 12340
 WELD TIME 02 ~
POS+ 032.6 kA
NEG- 032.6 kA
```

```
PRG 001  SPOT 12340
 WELD TIME 10 ~
POS+ 032.6 kA
NEG- 032.6 kA
```

Press key ▶ again to check the **stepper function** state.

```
SPOT MAX 12340
SPOTS 00000
INCREMENT 00% OF 00%
STEP NUM. 00 OF 00
```

SPOT MAX 12340
It indicates the maximum spots number programmed in the stepper function.

SPOTS 00000
It indicates the number of the already welded spots.

INCREMENT 00% OF 00%
It indicates both the carried out stepper value and the value to be reached, both expressed in percentage.

STEP NUM. 00 OF 00
It indicates the carried out segment spot and the spot to be reached.

Press key ▶ again to verify another weld analysis in ENERGY mode.
This frame may be displayed by means of the supplementary expansion board item 50200 only.

```
PRG 001  SPOT 12340
CYC 01 ENERGY 00000J
V+ 00.00  E+ 00000J
V- 00.00  E+ 00000J
```

PRG 001
It indicates the program number used for carrying the last weld sequence.

SPOT 12340
It indicates the welded spot number being analyzed. It always stands for the last weld sequence.

CYC
It indicates the cycle of the whole welding time relevant to the welding being analyzed.

ENERGY
It indicates the total energy value of the welding being analyzed.

V+ 00.00 E+00000J
It indicates the voltage value, expressed in volts, of the welding cycle positive half-period and the relevant energy value, expressed in joule, of the cycle taken into consideration.

V- 00.00 E+00000J
It indicates the voltage value, expressed in volts, of the welding cycle negative half-period and the relevant energy value, expressed in joule, of the cycle taken into consideration.

By means of the keys + and −, it is possible to check the other cycles of the analyzed weld.

```
PRG 001  SPOT 12340
CYC 02 ENERGY 00000J
V+ 00.00  E+ 00000J
V- 00.00  E+ 00000J
```

```
PRG 001  SPOT 12340
CYC 10 ENERGY 00000J
V+ 00.00  E+ 00000J
V- 00.00  E+ 00000J
```

By pressing the key ▶ again, it is possible to check the measurements performed by the control unit when the position sensor is both present and enabled.

```
PRG 005  SPOT 01234

THICKNESS 02.486 mm
IDENTATION 0.000 mm
```

PRG 005
It indicates the program being used for performing the last welding cycle; it may be a number included within 001 and 250. It is displayed both in WELD and in NO WELD mode.

SPOT 01234
It indicates the spot number according to which the measurement was realized. It is displayed both in WELD and in NO WELD mode.

THICKNESS 02.486 mm
It indicates the original thickness of the material to be welded that the TE553 control unit measures prior to the current flow. This value is updated both in WELD and in NO WELD mode.

IDENTATION 0.000 mm
It indicates the penetration extent of the electrode in the welded material at the end of the welding cycle. This value is updated only in WELD mode and when the indentation measurement is enabled in the welding program being used.

Press key ▶ again to check the **list of displayed errors.**

```
ERRLOG 01 SPOT 0011
      ERR 0101
NO EMERGENCY ERROR
OR RELE RESTART ERR
```

ERRLOG 01
It indicates which error is being displayed in chronological order. The last chronologically displayed error is expressed by number 01: the other errors are then stored by increasing numbers. A maximum of 20 errors can be stored; on exceeding this quantity, the oldest errors are deleted to be substituted with the most recent ones.

SPOT 00011
It indicates at which weld spot the error occurred. The number is relevant to the counted welded spots. Therefore it may happen that the spots number of several consequent errors is not shown in increasing numerical order since the counter might have been cleared in the meantime.

ERR 0101
It indicates the error recognition number.

NO EMERGENCY ERROR OR RELE RESTART ERR
It indicates the message displayed together with the error recognition number. The displayed message is simplified: for further information, the complete errors list together with the relevant error explanations and their possible solutions are listed in the manual's relevant paragraph.

Use keys + and − to see the other errors displayed beforehand on the control unit.

```
ERRLOG 02 SPOT 00175
      ERR 0106
   STOP LIMIT
  LOW CURRENT
```

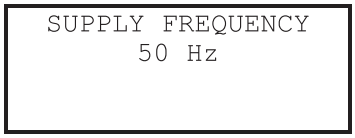
```
ERRLOG 20 SPOT 00138
      ERR 0102
  THERMOSTAT OR
FLOWSWITCH ERROR
```

Use key ◀ to return to the previous screens.

Use key ▶ to return to the main weld screen.

1.5 - 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.



After a few seconds, the TE553 displays the following frame and is set to a waiting condition until the Restart key is pressed

The RESTART command may be activated by pressing the proper key placed on the control unit (also a non-manual activation is available).
This key enables the control unit's commands and outputs**. It must be pressed every time the control unit is powered.**

When the RESTART command is activated, all the devices connected to the VAUX outlet are powered.

Before activating the RESTART command, 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.

For safety reasons, the microprocessor does not activate the welding cycle if the cycle start signal is already activated at the moment when the welder is switched on; it is sufficient to remove the command and activate it again. Micro-interruptions or excessive voltage drops, instead of affecting the operating mode, do stop the control unit. In order to restore its operating mode, it is sufficient to switch off and switch on the welder again.

CHAPTER 2 – CONTROL UNIT PROGRAMMING

By placing the key in PROGRAM DATA position the following frame is displayed:

```
-TE553 VER. 1.50 --
>PROGRAM DATA
 SETUP MENU
 STEPPER MENU
```

The first row reports the control unit type and the software version. Then the display lists all the menus that allow access to the various control unit functions.

The following list includes all the menus available in the control unit. However, it is possible that not all of these menus are displayed by the control unit being used as some of them depends either on the options actually inserted in the control unit or on the welder type the control unit is installed onto.

_ PROGRAM DATA
_ SETUP MENU
_ STEPPER MENU
_ FEATURES MENU
_ PROGRAM COPY
_ CHECK INPUT
_ PROG. SEQUENCE ***(It may be activated)***
_ TIP-DRESSING ***(It may be activated)***
_ THICKNESS SENSE ***(It may be activated)***

```
-TE553 VER. 1.50 --
 PROGRAM DATA
>SETUP MENU
 STEPPER MENU
```

Use keys ▲ and ▼ to vertically move the cursor identified by the arrow > shown on the left-hand side of the menus. Use keys ▶ and ◀ to enter and exit the menu selected by the cursor.
By means of the keys + and − it is possible to modify the parameter indicated by the cursor.

```
   PROGRAM DATA
 CONTROL MODE    CUR
>SQUEEZE 1        25
 SLOPE UP         00
```

2.1 - PROGRAM DATA

```
-TE553 VER.1.50 --
>PROGRAM DATA
 SETUP MENU
 STEPPER MENU
```

The **PROGRAM DATA** menu contains all the parameters associated with the welding cycle and the times and currents by means of which to carry out the weld.

```
   PROGRAM DATA
>PROGRAM N.      001
 WORKING MODE    FIX
 CONTROL MODE    CUR
```

The first choice is relevant to the number of the program to be used. Choose among the 250 stored programs through keys [+] and [−].
Then proceed with the next parameters moving with the [▲] and [▼] keys, setting the required values one at a time always using the [+] and [−] keys.

As such all the parameters will be set to the desired value for carrying out the welding process.
Please, beware that the data is saved only and exclusively if the program is exited or if the key is turned in RUN position.

Here as follows, the three working modes are described and the three possible programming frames are displayed according to the selected parameter in WORKING MODE. The frames are complete with all the programmable parameters.

2.2 - PERCENTAGE ADJUSTMENT OPERATING MODE

WORKING MODE parameter selected in FIX, the working frame is the following one:

```
PROG. 001 SPOT 12340
 WELD CYCLE 10.0 ~
CURRENT RMS 032.6 kA
```

In the FIX percentage adjustment operating mode, it is possible to set the percentage value one wants to carry the welding process out with. In this mode, the control unit measures the true efficacious welding current RMS value and, at the end of the welding process, it displays the current value.

The percentage adjustment operating mode does not foresee any secondary coil feedback during the welding process; for this reason, it is suitable for being used especially when one operates in difficult working conditions, beyond the welding tables, as for instance when using a very short welding time where it would be critical to use one of the more complex working modes foreseen in this control unit.

TECNA sets the map for the correlation between the set percentage and the closing time of the controlled diodes (SCR), which cannot be perfectly linear. To improve the linearity of the scale, a parameter was added to the FEATURES MENU for delaying the weld start time. For any further information refer to the relevant paragraph.

TABLE PERCENTAGE OPERATING MODE PARAMETERS

```
   PROGRAM DATA
>PROGRAM N.      001
 WORKING MODE    FIX
 CONTROL MODE    CUR
```

PARAMETER	RANGE VALUE
PROGRAM N.	001 – 250
WORKING MODE	FIX
CONTROL MODE *	NO
QUALITY – T *	OFF
SQUEEZE 1	01 - 99 cycles
SQUEEZE	00 - 99 cycles
PRESSURE	00.5 - 10.0 bar
FORGE DELAY	00 - 99 cycles
FORG.PRESS.	00.5 - 10.0 bar
PRE-WELD	00.0 - 99.5 cycles
PRE-POWER	05 - 99 %
COLD 1	00 - 50 cycles
SLOPE UP	00 - 25 cycles
WELD	01.0 - 99.5 cycles
POWER	05 - 99 %
IMPULSE N.	01 – 09
COLD 2	00 - 50 cycles
SLOPE DOWN	00 - 25 cycles
COLD 3	00 - 50 cycles
POST-WELD	00.0 - 99.5 cycles
POST-POWER	05 - 99 %
HOLD TIME	01 - 99 cycles
OFF TIME	00 - 99 cycles

CONTROL MODE *	CURR
CURR. MIN	0.5 - 90.0 kA
CURR. MAX	0.5 - 90.0 kA

QUALITY - T*	THICK
THICK. MIN	00.00 – 60.00 mm
THICK. MAX	00.00 – 60.00 mm

QUALITY - T*	IDENT
IDENT. MIN	0.000 – 6.000 mm
IDENT. MAX	0.000 – 6.000 mm

QUALITY - T*	TH+ID
THICK. MIN	00.00 – 60.00 mm
THICK. MAX	00.00 – 60.00 mm
IDENT. MIN	0.000 – 6.000 mm
IDENT. MAX	0.000 – 6.000 mm

QUALITY - T*	ZERO

There are some peculiar conditions:

- If the OFF TIME is set to 0, the control unit will work in single cycle.
- By setting the PRE-WELD parameter to zero, the pre-welding process will not be carried out.
- By setting the POST-WELD parameter to zero, the post-welding process will not be carried out.
- By setting the same value for both CURR. MIN and CURR. MAX, the limits are disabled.
- By setting the same value for both THICK. MIN and THICK. MAX, the limits are disabled.
- By setting the same value for both IDENT. MIN and IDENT. MAX, the limits are disabled.

It is advisable to activate the CONTROL MODE in CUR and check the limit use conditions before beginning the production cycle: if used with 2 metal sheets for instance, limit conditions are with 1 or 3 metal sheets. The TE553 control unit adjusts the welding current. However, it is necessary to check the welding current value with one sheet so to be set as minimum limit and to check it with 3 sheets so to be set as maximum limit.
However, it is not possible to undoubtedly assure that the piece has been effectively welded, as all the conditions and parameters involved in the welding process execution should be checked.

2.3 - CONSTANT ENERGY OPERATING MODE

WORKING MODE parameter selected in ENE, the working frame is the following one:

```
PROG. 001 SPOT 12340
 WELD CYCLE 10.0 ~
RMS 032.6kA
ENERGY 01351 joule
```

With a constant energy control unit, all the settings are made as for conventional control units except for the ENERGY parameter and the welding time parameter, where a set rating is not required but minimum and maximum ratings are set.

During welding, the control unit reads the true efficacious welding current RMS, the non-inductive component of the voltage at the electrodes in volts and the welding duration in cycles. The product of I x V x time gives the thermal energy produced during welding, expressed in joules (W x sec).

Since the energy subtracted by conduction and that dissipated between the external sheets and the electrodes, reduce the precision of the energy measured, it is advisable to weld with short timings and high electrode force. Therefore it is important, for good execution of the spot quality control, that the welding machine it is applied to has adequate specifications relating to power, electrode force and welding current for the execution of high A and B class spots.

To ensure correct use of the control unit in this operating mode, we recommend following the procedure below step by step:

1. adjust the welding pressure, the welding current and the diameter of the electrodes according to the traditional tables for the execution of the required welding.
2. disable the STEPPER MENU function or the dressing function if activated.
3. adjust the minimum welding time to the same as the maximum welding time (WELD MIN = WELD MAX) with the cycles value indicated in the traditional welding tables.
4. carry one spot weld out and verify that it is satisfactory
5. read the value of the total developed energy and set it in the ENERGY parameter of the working program
6. adjust the minimum time (WELD MIN) to the number of periods necessary for carrying the spot out with the new electrodes
7. adjust the maximum time (WELD MAX) to a number of periods that does not spoil the piece

ENERGY TREND READINGS DURING WELDING

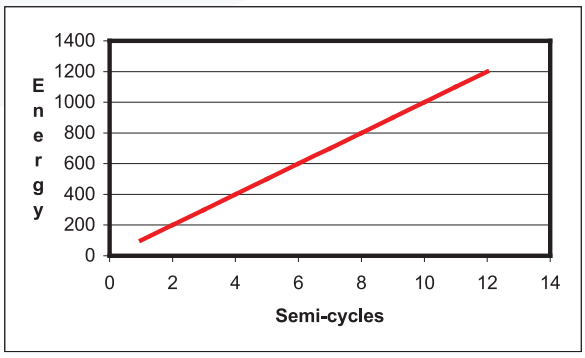


TABLE CONSTANT ENERGY OPERATING MODE PARAMETERS

```
   PROGRAM DATA
>PROGRAM N.      001
 WORKING MODE    ENE
 CONTROL MODE    CUR
```

PARAMETER	RANGE VALUE
PROGRAM N.	001 - 250
WORKING MODE	ENE
CONTROL MODE *	NO
QUALITY – T *	OFF
SQUEEZE 1	01 - 99 cycles
SQUEEZE	00 - 99 cycles
PRESSURE	00.5 - 10,0 bar
FORGE DELAY	00 - 99 cycles
FORG.PRESS.	00.5 - 10,0 bar
SLOPE UP	00 – 25 cycles
WELD MIN	00.5 - 99.5 cycles
WELD MAX	00.5 - 99.5 cycles
POWER	05 - 99 %
ENERGY	00060-60000 joule
COLD 3	00 – 50 cycles
POST-WELD	00.0 – 99.5 c cycles
POST-POWER	05 – 99 %
HOLD TIME	01 – 99 cycles
OFF TIME	00 – 99 c cycles

CONTROL MODE *	CURR
CURR. MIN	1.0 - 90.0 kA
CURR. MAX	1.0 - 90.0 kA

QUALITY - T*	THICK
THICK. MIN	00.00 – 60.00 mm
THICK. MAX	00.00 – 60.00 mm

QUALITY - T*	IDENT
IDENT. MIN	0.000 – 6.000 mm
IDENT. MAX	0.000 – 6.000 mm

QUALITY - T*	TH+ID
THICK. MIN	00.00 – 60.00 mm
THICK. MAX	00.00 – 60.00 mm
IDENT. MIN	0.000 – 6.000 mm
IDENT. MAX	0.000 – 6.000 mm

QUALITY - T*	ZERO

There are some peculiar conditions:

- If the OFF TIME is set to 0, the control unit will work in single cycle.
- By setting the POST-WELD parameter to zero, the post-welding process will not be carried out.
- By setting the same value for both CURR. MIN and CURR. MAX, the limits are disabled.
- By setting the same value for both THICK. MIN and THICK. MAX, the limits are disabled.
- By setting the same value for both IDENT. MIN and IDENT. MAX, the limits are disabled.

It is advisable to activate the CONTROL MODE in CUR and check the limit use conditions before beginning the production cycle: if used with 2 metal sheets for instance, limit conditions are with 1 or 3 metal sheets. The TE553 control unit adjusts the constant energy. However, it is necessary to check the welding current value with one sheet so to be set as minimum limit and to check it with 3 sheets so to be set as maximum limit.
However, it is not possible to undoubtedly assure that the piece has been effectively welded, as all the conditions and parameters involved in the welding process execution should be checked.

2.4 - DESCRIPTION OF THE WORKING PROGRAM PARAMETERS

All the following parameters indicating a period of time are expressed in periods, also called mains cycles. The mains frequency defines the duration of a cycle.

Mains frequency 50 Hz 1 period = 20 ms

Mains frequency 60 Hz 1 period = 16.6 ms

WORKING MODE

The WORKING MODE parameter defines the adjustment mode for the program's welding current: adjustment by power percentage (**FIX**) and by constant energy (**ENE**).
This parameter only affects the weld time (WELD) that will be carried out in the adjustment mode set in this parameter. The pre-weld (PRE-WELD) and post-weld (POST-WELD) times are always carried out through power percentage adjustment.

CONTROL MODE

This parameter permits to select the control mode of the desired welding current.

- **NO** *No control is performed to the supplied welding current.*
- **CUR** *The welding current min. and max. limits may be set.*

QUALITY - T

This parameter allows selecting whether and which control to perform on the mechanical features of the welded material. The checks are performed prior to the welding current flow for the measurement of the original thickness of the material to be welded and after the welding current flow so to measure the electrodes penetration within the material to be welded.
It is possible to enable this control mode only if the appropriate position sensor is properly installed on the spot welder. Then, it can be activated by the THICK SENSOR parameter in the FEATURES MENU.

The QUALITY – T parameter may be set according to the following values:

- **OFF** No control is run over the mechanical features of the material placed between the electrodes.
- **ZERO** By means of this mode, the control unit calculates the ZERO share which is used as a reference for the measurements of thickness and penetration. The TE553 control unit automatically shifts in NO WELD mode making it necessary to perform a welding cycle without any material between the electrodes. **The ZERO procedure is required each time the machine is turned on, when the secondary geometry of the welder is changed and when maintenance is performed at the electrodes.**

- **THICK** The thickness of the material to be welded is measured at the end of the SQUEEZE1 and SQUEEZE times (if present) prior to the welding current flow. On the quality analysis screen, it is possible to check the THICKNESS measured by the control unit.

```
PRG 005    SPOT 01234

THICKNESS 02.486 mm
IDENTATION 0.000 mm
```

  Both the minimum and maximum limit can be set on the performed measurement.

- **IDENT** At the end of the welding current flow and prior to the HOLD time, it is measured the penetration of the electrodes within the material which occurred during welding. On the quality analysis screen, it is possible to check the IDENTATION (electrodes penetration) measured by the control unit.

```
PRG 005    SPOT 01234

THICKNESS 00.000 mm
IDENTATION 0.123 mm
```

  Both the minimum and maximum limit can be set on the performed measurement.

  Correct penetration values can be found on appropriate welding tables based on the type of material to be welded.

- **TH+ID** Both measurements are performed prior to and after the welding process and the minimum and maximum limits can be set on both of them.

By setting the QUALITY - T parameter on THICK or on TH+ID, the mode relevant to **the limits on the material original thickness** is activated.

In this case, two new parameters will be displayed:

THICK. MIN lower limit of the material original thickness

THICK. MAX upper limit of the material original thickness

which allow setting material thickness limit values at the beginning of the welding process.

```
  PROGRAM DATA
 WORKING MODE     FIX
 CONTROL MODE      NO
>QUALITY - T    THICK
```

```
  PROGRAM DATA
>PAUSE              00
 THICK. MIN   02.00mm
 THICK. MAX   02.25mm
```

When in the mode for controlling the original thickness (QUALITY - T = THICK o TH+ID), should the value of the original thickness be less than or greater than the values set in the parameters described above, then either one of the below messages is displayed:

```
      ERR 0124
    THICKNESS
 UNDER LOW LIMIT
```

```
      ERR 0125
    THICKNESS
 OVER HIGH LIMIT
```

By setting the QUALITY - T parameter on IDENT or on TH+ID, the mode relevant to **the limits on the electrode penetration** is activated.

In this case, two new parameters will be displayed:

IDENT. MIN lower limit of the electrode penetration at the end of the welding process
IDENT. MAX upper limit of the electrode penetration at the end of the welding process

which allow setting electrode penetration limit values at the end of the welding process.

```
  PROGRAM DATA
 WORKING MODE     FIX
 CONTROL MODE      NO
>QUALITY - T    IDENT
```

```
  PROGRAM DATA
>PAUSE              00
 IDENT. MIN   1.000mm
 IDENT. MAX   1.500mm
```

When in the mode for controlling the electrode penetration (QUALITY - T = IDENT o TH+ID), should the value of the penetration be less than or greater than the values set in the parameters described above, then either one of the below messages is displayed:

```
     ERR 0126
    IDENTATION
  UNDER LOW LIMIT
```

```
     ERR 0127
    IDENTATION
  OVER HIGH LIMIT
```

SQUEEZE 1

The SQUEEZE 1 time determines the time needed by the electrode to move down.
If a simple pneumatic circuit is present, such time represents the interval of time that elapses from the beginning of the head descent to the welding process beginning. The set value must be long enough to allow the electrodes to achieve the proper clamping force, before the welding process begins.
In a pneumatic circuit with low-pressure squeeze, the SQUEEZE 1 time is combined with the SQUEEZE time where the SQUEEZE 1 time is the one determining the duration of the interval of time that elapses from the beginning of the head descent to the application of the welding pressure. The set value must be long enough to allow the electrodes to reach the work piece to be welded. During the SQUEEZE 1 time, it is possible to end the cycle by disabling the start cycle signal.

SQUEEZE

The SQUEEZE time is a wait time like that of the SQUEEZE 1. 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 SV2) 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. The squeeze time may be activated by means of the LOW FORCE SQ parameter in the FEATURES MENU. It is advisable to activate this parameter only if the welding machine is programmed for a low-pressure squeeze employing a suitable pneumatic circuit. The SQUEEZE time is added to the SQUEEZE 1 time. If the start cycle signal is deactivated during the squeeze time, the sequence is interrupted.

PRESSURE

This parameter, expressed in bar, expresses the welding pressure value. It is used only if in the pneumatic circuit a proportional valve is present. 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. This parameter may be activated through the PROP. VALVE function in the **FEATURES MENU**.

FORGE DELAY

The FORGE DELAY parameter expresses the delay time elapsing from the welding process beginning and the application of the forging force. It is used exclusively with pneumatic circuits that contemplate the forging function. Such function activates SV3 which permits to increase the electrode force during the welding cycle.
If the value is set to zero the FORGE DELAY function is disabled. However, SV3 would be anyway activated at the same time of either the SQUEEZE 1 time or the SQUEEZE time, if the relevant function has been activated. This parameter may be activated through the relevant function in the **FEATURES MENU**.

FORGE PRESS.

This parameter, expressed in bar, describes the forging pressure value; It is used only if in the pneumatic circuit a proportional valve is present. The set value must be such that it guarantees a proper clamping force during the forging. An inadequate adjustment of such value produces sparks between electrodes and sheet during the welding process. This parameter may be activated through the FORGE and PROP. VALVE parameters in the **FEATURES MENU**.

MOTOR DELAY

This parameter describes the time that elapses between the beginning of the weld and the activation of the motor through control unit output SV3. This parameter is displayed only on selecting the SEAM WELD MODE parameter to ON, present in the FEATURES MENU.

PRE-WELD

The PRE-WELD parameter indicates the duration of a current flow that can be carried out before the welding process. This parameter is expressed by three digits since it can be set with half-cycle precision. If this parameter is set to 0, the pre-weld will not be carried out.
The PRE-WELD is carried out with a current adjustment equivalent to that indicated in the PRE-POWER parameter. This parameter may be activated through the relevant function in the **SETUP MENU**.

PRE-POWER

The value expressed in this parameter indicates the power used for carrying the PRE-WELD out. This parameter may be activated through the relevant function in the **SETUP MENU**.

COLD 1

The COLD 1 parameter indicates the time that elapses from the pre-weld to the weld.
If the pre-weld is deactivated (that is, when PRE-WELD time = 0), this cooling time is not carried out. This parameter may be activated through the relevant function in the **SETUP MENU**.

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 POWER. The slope up inclination is automatically calculated by the microprocessor according to the set values. The SLOPE UP time is added to the welding time.

WELD

The WELD time parameter indicates the welding current flow duration. It is carried out with the same power value set at parameter POWER.
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-cycle precision.

WELD MIN

The minimum weld time parameter (WELD MIN) is expressed in cycles and represents the welding duration minimum time. It is carried out with the same power value set at parameter POWER. Welding will stop if the energy measured at the end of this period of time is above or equal to the programmed rating.
This parameter is only displayed when the WORKING MODE is selected in ENE (Constant Energy operating mode).

WELD MAX

The maximum weld time parameter (WELD MAX) is expressed in cycles and represents the welding duration maximum time. It is carried out with the same power value set at parameter POWER. Welding will stop also if the energy measured at the end of this period of time is below the programmed rating.
This parameter is only displayed when the WORKING MODE is selected in ENE (Constant Energy operating mode).

POWER

The value expressed in the POWER parameter indicates the power adjustment the welding process is carried out with.
This parameter is only displayed when either FIX (Power operating mode) or ENE (Constant Energy operating mode) are selected.

ENERGY

This parameter indicates the energy value, expressed in joules, which must be developed during welding. This rating must be reached in a number of cycles between the minimum time and the maximum time.
This parameter is only displayed when ENE (Constant Energy operating mode) is selected.

IMPULSE N.

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

COLD 2

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. When the impulse number is set to zero, the cold time 2, even if programmed, is not carried out.

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 POWER down to the minimum value. The slope down inclination is automatically calculated by the microprocessor according to the set values. The SLOPE DOWN time is always added to the welding time.
This parameter may be activated through the relevant function in the **SETUP MENU**.

COLD 3

The cold 3 time parameter (COLD 3 TIME) indicates the time that elapses between the WELD time and the POST-WELD time. This parameter is activated through the specific function in the **SETUP MENU**.

POST-WELD

The POST-WELD time parameter indicates the duration of a current flow that can be carried out after the welding time. This parameter is expressed by three digits since it can be adjusted with half-cycle precision. If this parameter is set to 0 the post-weld is not carried out. The post-weld is carried out with a current adjustment equal to the one set in the POST-POWER parameter. This parameter may be activated through the relevant function in the **SETUP MENU**.

POST-POWER

The value expressed in this parameter indicates the post-welding power. This parameter may be activated through the relevant function in the **SETUP MENU**.

POWER 3

The value expressed in this parameter indicates the second power that may be called through the specific input in seam weld mode. This parameter is displayed only on selecting the SEAM WELD MODE parameter to ON, present in the **FEATURES MENU**.

HOLD TIME

The (HOLD TIME) 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

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 0, 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.

CURR MIN

This parameter fixes a minimum current limit value. For each weld, the control unit 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).
This parameter may be activated by setting the CURR. CONTROL MODE. If the CONTROL MODE parameter is programmed to NO, the parameter will not be displayed during the programming stage.

CURR MAX

This parameter fixes a maximum current limit value. For each weld, the control unit monitors that the welding current supplied by the welder is lower than the value set at this parameter; if it is higher, an error message will be displayed (see the relevant paragraph).
This parameter may be activated by setting the CURR. CONTROL MODE. If the CONTROL MODE parameter is programmed to NO, the parameter will not be displayed during the programming stage.

THICK. MIN

This parameter fixes a lower limit with regard to the minimum thickness of the material placed between the electrodes. Before the welding process is activated, the measurement of the thickness of the material between the electrodes must be greater than the set minimum limit. Otherwise, an error message will be displayed.
This parameter can be activated by setting QUALITY - T on THICK or on TH+ID, otherwise this parameter is not displayed during programming.

THICK. MAX

This parameter fixes an upper limit with regard to the maximum thickness of the material placed between the electrodes. Before the welding process is activated, the measurement of the thickness of the material between the electrodes must be less than the set maximum limit. Otherwise, an error message will be displayed.
This parameter can be activated by setting QUALITY - T on THICK or on TH+ID, otherwise this parameter is not displayed during programming.

IDENT. MIN

This parameter fixes a lower limit with regard to the minimum measurement of the electrode penetration at the end of the welding process. At the end of the welding process, the measurement of the penetration value must be greater than the set limit. Otherwise, an error message will be displayed.
This parameter can be activated by setting QUALITY - T on IDENT or on TH+ID, otherwise this parameter is not displayed during programming.

IDENT. MAX

This parameter fixes an upper limit with regard to the maximum measurement of the electrode penetration at the end of the welding process. At the end of the welding process, the measurement of the penetration value must be less than the set limit. Otherwise, an error message will be displayed.
This parameter can be activated by setting QUALITY - T on IDENT or on TH+ID, otherwise this parameter is not displayed during programming.

2.5 - SETUP MENU

```
--TE553 VER.1.50 --
 PROGRAM DATA
>SETUP MENU
 STEPPER MENU
```

In this menu, the operator may find those parameters enabling to simplify the programming and better adjust the control unit to the user's exigencies.

```
   SETUP MENU
>START 1 PRG     010
 START 2 PRG     006
 PRINTER SPOTS  NONE
```

SETUP MENU PARAMETERS TABLE

PARAMETER	PARAMETER DESCRIPTION	VALUE
START 1 PRG	Start cycle 1 program	000 – 250
START 2 PRG	Start cycle 2 program	001 – 250
PRINTER SPOTS	Welding spots print	ALL – NONE – BAD
STOP BAD SPOTS	Number of spots for out-of-limit stop	0 – 15
AMMETER CAP.	Ammeter rating	56 – 126 kA
LANGUAGE	Language for describing parameters	ITA - ENG - SPA - DEU - FRA - UNG – POR - SWE- POL
PRE-WELD	It activates the parameters relevant to the PRE-WELD	ON - OFF
POST-WELD	It activates the parameters relevant to the POST-WELD	ON - OFF

START 1 PRG

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 selected in the programming frame.

START 2 PRG

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

PRINTER SPOTS

With this parameter, if the serial port is setup for print (see **FEATURES MENU** paragraph), the user can choose which welding spots to be printed. It is possible to disable the print, print all spots or only the spots whose current value remains out of the set limits values.

STOP BAD SPOTS

The STOP BAD SPOTS parameter allows the user to program the control unit to stop when welds are carried out with current values that are beyond the limits set in the weld program. The programmed value indicates the consecutive number of "out of limits" welds that cause the machine to stop. The limits error occurs when a weld is carried out with values that are higher or lower than the limits set in the MIN CURR. and MAX CURR. parameters.
Adjust the value through keys ⊞ and ⊟ from 0 to 15. When the value is set to zero the function is disabled. As such, if the pre-set limits are exceeded the welder will not stop.
For further information, please, check the relevant paragraph.

AMMETER CAP.

This parameter indicates the control unit's ammeter rating. Set the following parameter higher than the welder's max short circuit current.
Also consult the sensitivity parameter of the COIL RATIO transducer in the FEATURES MENU.

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.
One may select the following languages: ITALIAN – ENGLISH – SPANISH – GERMAN – FRENCH – HUNGARIAN – PORTUGUESE – SWEDISH – POLISH.

PRE-WELD

By setting it to ON, it activates the following parameters: PRE-WELD, PRE-POWER and COLD 1 in all the programs.

POST-WELD

By setting it to ON, it activates the following parameters: SLOPE DOWN, COLD 3, POST-WELD and POST-POWER in all the programs.

2.6 - STEPPER MENU

```
  TE553 VER.1.50
>PROGRAM DATA
 SETUP MENU
 STEPPER MENU
```

This menu contains parameters associated with the current stepper operations.

```
    STEPPER MENU
>TOTAL STEPS      3
 SPOTS 1       04000
 INCREMENT 1   12 %
```

In order to use this function, the electrodes dressing function (option with board 50200) must be disabled.

STEPPER MENU PARAMETERS TABLE

PARAMETER	PARAMETER DESCRIPTION	RANGE VALUE
TOTAL STEPS	Number of segments to be activated	0 – 7
SPOTS 1	Spots step 1	00000 - 10000
INCREMENT 1	Percent increment step 1	00 - 60
SPOTS 2	Spots step 2	0001 - 5000
INCREMENT 2	Percent increment step 2	00 - 60
SPOTS 3	Spots step 3	0001 - 5000
INCREMENT 3	Percent increment step 3	00 - 60
SPOTS 4	Spots step 4	0001 - 5000
INCREMENT 4	Percent increment step 4	00 - 60
SPOTS 5	Spots step 5	0001 - 5000
INCREMENT 5	Percent increment step 5	00 - 60
SPOTS 6	Spots step 6	0001 - 5000
INCREMENT 6	Percent increment step 6	00 - 60
SPOTS 7	Spots step 7	0001 - 5000
INCREMENT 7	Percent increment step 7	00 - 60

TOTAL STEPS

This parameter indicates how many segments are to be created for implementing the stepper curve.
When it is set to zero, the stepper function is disabled.

SPOTS 1

This parameter indicates the number of spots of which the associated segment is composed.
When it is set to zero, the stepper function is disabled.
When TOTAL STEPS = 0 and SPOTS 1 ≠ 0, the value set in the SPOTS 1 parameter is equal to the number of welding maximum spots.

INCREMENT 1

This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.
When it is set to zero, the stepper function is disabled.

SPOTS 2
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 2
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

SPOTS 3
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 3
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

SPOTS 4
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 4
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

SPOTS 5
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 5
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

SPOTS 6
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 6
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

SPOTS 7
This parameter indicates the number of spots of which the associated segment is composed.

INCREMENT 7
This parameter indicates the current stepper percentage to be attained upon the completing of the spots set in the associated segment.

2.7 - 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 work piece to be welded increases and, as a consequence, the welding current density (Ampere/mm^2) decreases. If the current adjustment is maintained at a fixed value throughout the whole electrodes 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 percentage are programmed.

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

If the current or conduction angle limits are used, they will be increased by the same percentage, as are the settings for the pre-welding current and post-welding current, and the energy level to attain.

During the welding process, it is possible to correct the stepper curve trend by changing the parameters determining its trend.

In order to start a new stepper curve, it is necessary to clear the counter and restore the starting diameter of the electrodes.

SIMPLIFIED USE OF THE STEPPER FUNCTION (LINEAR STEPPER)

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.

```
    STEPPER MENU
>TOTAL STEPS      1
 SPOTS 1       02000
 INCREMENT 1   26 %
```

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 TOTAL STEPS 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:

The welding tests proved that: the electrode life corresponds to 2000 welding spots; that with new electrodes the required current is 15 kA; that after 2000 spots the electrodes diameter increment requires a 19 kA current.

The percent variation is calculated 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	PARAMETER DESCRIPTION	VALUE
TOTAL STEPS	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.

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

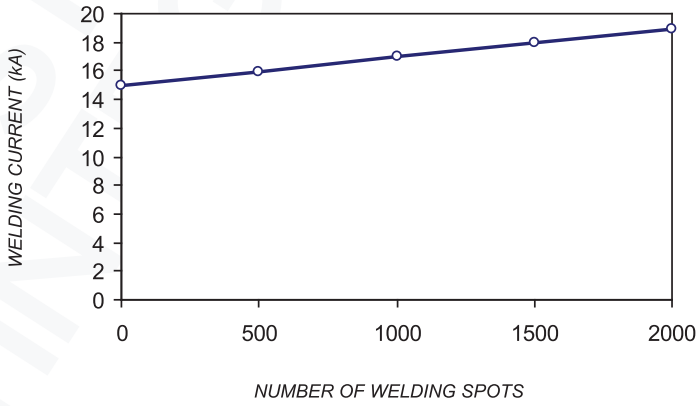
CURRENT INCREASE DURING THE PRODUCTION

INITIAL CURRENT = 15 kA

FINAL CURRENT = 19 kA

INCREMENT PERCENT = 26 %

WELDING SPOTS NUMBERS = 2000



On having completed the 2000 welding spots, the control unit stops the production cycle and displays the following message:

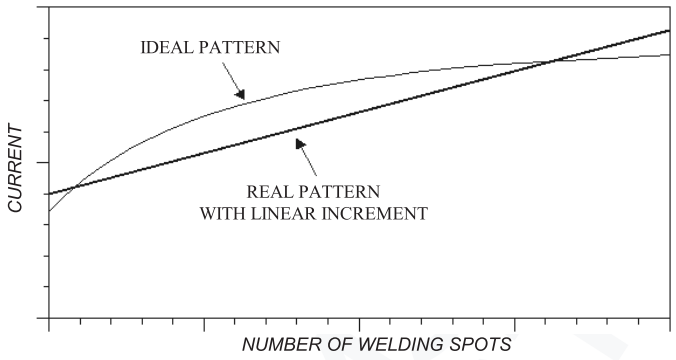
```
ERR 104
MAX SPOTS NUMBER
```

At this point the operator replaces the electrodes (or resets their original diameter) and clears the spots counter to clear stepper calculations.

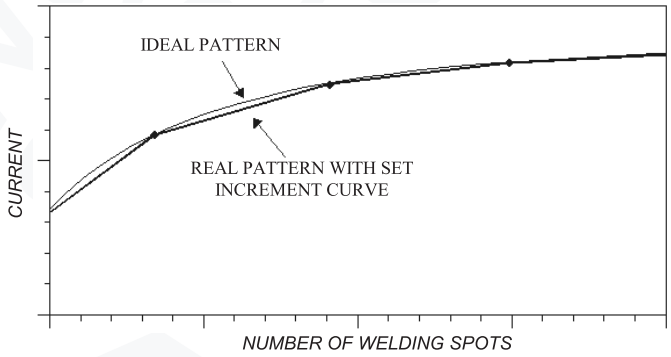
The TE553 resets the initial work parameters and begins a new increment phase.

COMPLETE USE OF THE STEPPER MENU FUNCTION (NON-LINEAR INCREMENT CURVE)

It is possible to use the non-linear increment curve function by knowing the real electrodes consumption only.
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.

```
    STEPPER MENU
>TOTAL STEPS      4
 SPOTS 1       00700
 INCREMENT 1   19 %
```

The TOTAL STEPS parameter determines the number of segments the user wishes to enter in the stepper curve. In parameters SPOTS 1,2… the user enters the number of welds that make up the segment, in parameters INCREMENT 1,2… the user enters the relative increment in percentage to be achieved.
The programming procedure is outlined in the **STEPPER MENU** paragraph.

Example:

Welding tests have determined that the electrode life corresponds to 4000 welding spots, and that the following currents values are necessary at 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 (final electrode diameter)	20.7 kA

Therefore calculate the duration (in number of welding spots) and the percent increment of each segment.
Please, notice that the percent increment must always be calculated referring to the beginning of the considered segment.

$$\text{Duration of segment } 1 = 700 - 0 = 700 \text{ spots}$$

$$\text{Duration of segment } 2 = 1800 - 700 = 1100 \text{ spots}$$

$$\text{Duration of segment } 3 = 3000 - 1800 = 1200 \text{ spots}$$

$$\text{Duration of segment } 4 = 4000 - 3000 = 1000 \text{ spots}$$

$$Change\ \%\ segment\ 1 = \frac{end\ current - initial\ current}{initial\ current} \times 100 = \frac{17.8 - 15}{15} \times 100 = 19\%$$

$$Change\ \%\ segment\ 2 = \frac{end\ current - initial\ current}{initial\ current} \times 100 = \frac{19.5 - 17.8}{17.8} \times 100 = 10\%$$

$$Change\ \%\ segment\ 3 = \frac{end\ current - initial\ current}{initial\ current} \times 100 = \frac{20.2 - 19.5}{19.5} \times 100 = 4\%$$

$$Change\ \%\ segment\ 4 = \frac{end\ current - initial\ current}{initial\ current} \times 100 = \frac{20.8 - 20.2}{20.2} \times 100 = 3\%$$

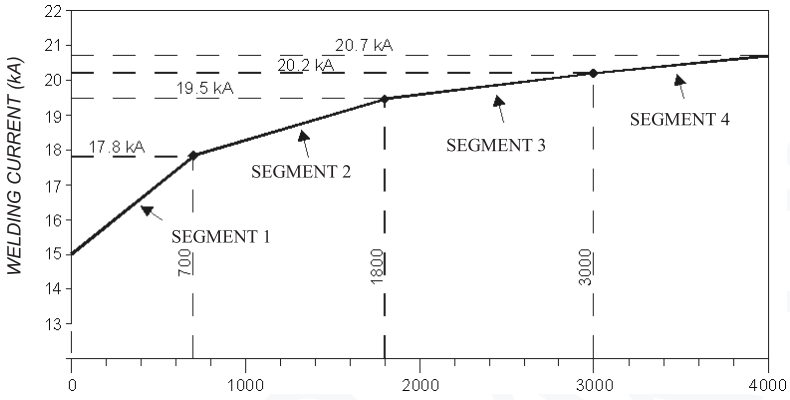
The following parameters are consequently set in the **STEPPER MENU**:

PARAMETER	PARAMETER DESCRIPTION	VALUE
TOTAL STEPS	Number of segments for stepper function	4
SPOTS 1	First segment spots number	700
INCREMENT 1	First segment increment percent	19
SPOTS 2	Second segment spots number	1100
INCREMENT 2	Increment percent of second segment	10
SPOTS 3	Third segment spots number	1200
INCREMENT 3	Increment percent of third segment	4
SPOTS 4	Fourth segment spots number	1000
INCREMENT 4	Increment percent of fourth segment	3

The welding program must be set in order to carry out the first welding spot that is with an adjustment enabling to obtain the necessary current with the starting electrodes diameter: 15kA.

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

CURRENT INCREASE DURING THE PRODUCTION



On having completed the 4000 welding spots, the control unit stops the production cycle and displays the following message:

```
ERR 104
MAX SPOTS NUMBER
```

At this point the operator replaces the electrodes (or resets their original diameter) and clears the spots counter, by means of the proper key, to clear stepper calculations.
The TE553 resets the initial work parameters and begins a new increment phase.

2.8 - FEATURES MENU

```
-TE553  VER. 1.50--
 SETUP MENU
 STEPPER MENU
>FEATURES MENU
```

The features 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.

```
 ENTER ACCESS CODE
 FOR FEATURES MENU
   -  -  -  -  -
```

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

```
     WRONG CODE
     TRY AGAIN!
```

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

```
    FEATURES MENU
>FIRST INSERT    70
 SERIAL COM.    OFF
 NET ADDRESS     01
```

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

PARAMETER	PARAMETER DESCRIPTION	RANGE VALUE
FIRST INSERT.	1st Insertion delay	01 –99
SERIAL COM.	Serial communication	232 – 485 – USB - OFF
NET ADDRESS	Network address	01 – 31
COIL RATIO	Rogowski ratio	X 0.5 – X1 –X5 – X10
LOCK/END OUT	Output function	END – LOCK
FUNCTION RIC5	Recall function 5	REC – ODD - EVEN
LOW FORCE SQ.	Low force squeeze	ON - OFF
FORGE	Forging	ON – OFF
PROP. VALVE	Proportional valve	ON - OFF
PRESSURE RATIO	Proportional ratio	0.1 – 2.0
AUTORETAIN	Start Autoretain	ON – OFF
DIODES CONSTANT	Factor for diode protection	000 – 240
SEAM WELD MODE	Spots / seams	ON – OFF
CASCADE MODE	Electric cascade function	ON – OFF
IMAX TRASF.	Transformer max current	002.0 – 500.0
THICK SENSOR	Position sensor function	ON – OFF
VOLTAGE RANGE	Electrodes voltage rating	5V – 10V – 20V
BACKUP USB	USB Backup function	<+>
RESTORE USB	USB Restore function	<+>
SET DATE-TIME	Set USB calendar - clock	<+>

FIRST INSERT

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

SERIAL COM.

The user may choose whether to activate the serial data transmission port and how it is to be used, connect a printer (232) or connect the control unit to a data supervision network (485), or connect an external storage medium (USB) or decide not to use this option (OFF).

NET 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
X 0.5	75 mV/ kA	112 – 252 kA
X 1	150 mV / kA	56 – 126 kA
X 5	750 mV / kA	11 – 25 kA
X 10	1.5 V / kA	5 – 12 kA

OUT LOCK/END

This parameter is used to indicate the time for activation of the corresponding output, interlock (LOCK) or end of cycle (END).

FUNCTION RIC5

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

LOW FORCE SQ.

This parameter is used for enabling the low-pressure squeeze function for pneumatic circuit welders that are equipped with this function. Its enabling adds the SQUEEZE parameter to the welding program.

FORGE

This parameter is used for enabling the forging for pneumatic circuit welders that are equipped with this function. Its enabling adds the FORGE DELAY parameter to the work program.

PROP. VALVE

This parameter is used for enabling the use of a proportional valve for pneumatic circuit welders that are equipped with this function. Its enabling adds the PRESSURE parameter to the work program.
If the FORGE parameter is enabled too, then the FORG.PRESS. parameter is added to the work program.

PRESSURE RATIO

This parameter can be used to select the optimum bar/Volt ratio for the type of proportional solenoid valve that is to be employed. It works only if the PROP. VALVE parameter is enabled.
Further pieces of information are described in the paragraph **INTERFACE FOR PROPORTIONAL VALVE**.

AUTORETAIN

This parameter allows disabling the cycle start signal AUTORETAIN.
By setting the parameter on the OFF value, the working cycle is stopped the moment the cycle start signal is disabled and does not complete the welding time. This occurs even if the welding current is in its flowing phase.
The welding time is always completed whenever the value is set on ON.
This function is specifically to be used when the machine works with mechanical devices instead of pneumatic ones.

DIODES CONSTANT

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.

SEAM WELD MODE

By means of this parameter, it is possible to enable the function for adjusting the control unit to the seam welders' specifications.
Further pieces of information are described in the paragraph **SEAM WELD MODE.**

CASCADE MODE

This parameter allows reversing the outlet signal of the end cycle (END), that is to say from normally open contact to normally closed contact, so to allow putting in cascade more control units.
Check the proper paragraph for further information.

IMAX TRASF.

Currently, this parameter is not used.

THICK SENSOR

Upon enabling this parameter, there will be made available both the parameter QUALITY – T within the programs and the THICKNESS SENSE menu for the parameterization of the position sensors connected to the control unit.

VOLTAGE RANGE

This parameter allows the user to select the range, or max value, of the voltage acquisition input measured at the ends of the welding electrodes. The value of this parameter **must correspond** to the range selected on the acquisition module.
The control unit allows enabling this function only if the supplementary card is present, code 50200.

BACKUP USB

By pressing the <+> key when on this parameter, it is started the procedure for saving the data relevant to the parameters of all the menus of the welding control unit on an external USB flash memory.
The control unit displays this parameter only if the optional USB board (item 50288) is present and if the parameter SERIAL COM. is set on USB.
For further information, do refer to the installation and user manuals of the USB board item 50288.

RESTORE USB

By pressing the <+> key when on this parameter, it is started the procedure for restoring the data relevant to the parameters of all the menus of the welding control unit from an external USB flash memory.
The control unit displays this parameter only if the optional USB board (item 50288) is present and if the parameter SERIAL COM. is set on USB.
For further information, do refer to the installation and user manuals of the USB board item 50288.

SET DATE-TIME

By pressing the <+> key when on this parameter, it is possible to set the actual date and time for the external storage medium.
The control unit displays this parameter only if the optional USB board (item 50288) is present and if the parameter SERIAL COM. is set on USB.
For further information, do refer to the installation and user manuals of the USB board item 50288.

2.9 - PROGRAM COPY

```
-TE553  VER. 1.50--
 STEPPER MENU
 FEATURES MENU
>PROGRAM COPY
```

This 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 (so to make the programming quicker).

```
   PROGRAM COPY
>SOURCE PROGRAM  003
 COPY FROM PRG   006
 TO PROGRAM      010
```

After selecting the source program and the programs where it is to be saved, press the ◧ key for starting the copying procedure. The following message will be displayed. The bar indicates the copy progress.

```
    COPY PROGRAMS
     IN PROGRESS
     ▌▌▌▌▌▌▌▌
```

When the copying procedure is finished, the main programming frame is displayed.

```
-TE553  VER. 1.50--
 STEPPER MENU
 FEATURES MENU
>PROGRAM COPY
```

PROGRAM COPY MENU PARAMETERS TABLE

PARAMETER	PARAMETER DESCRIPTION	RANGE VALUE
SOURCE PROGRAM	Source program	001 – 250
COPY FROM PRG	Program start copy/target	001 – 250
TO PROGRAM	Copy end program	001 – 250

SOURCE PROGRAM
This program indicates the number of the program to be copied to other programs. The value of this parameter may vary from 001 to 250.

COPY FROM PRG
This program indicates the first program into which the source program is copied. The value of this parameter may vary from 001 to 250.

TO PROGRAM
This program indicates the last program into which to copy the source program. The value of this parameter may vary from 001 to 250.

2.10 - CHECK INPUT

```
-TE553  VER. 1.50--
 FEATURES MENU
 PROGRAM COPY
>CHECK INPUT
```

This menu displays the input status on the welding control unit. It is uses for check both the efficiency and the proper working of the external devices connected to the control unit and necessary for using the welder.

```
   CHECK INPUT
>START            OFF
 AUX              OFF
 AUX 3            OFF
```

The following inputs are present in the list scrolled through keys ▲ and ▼:

PARAMETER	PARAMETER DESCRIPTION	VALUE
START	It indicates the status of the cycle start signal	ON – OFF
AUX	It indicates the status of the auxiliary signal	ON – OFF
AUX 3	It indicates the status of the auxiliary 3 signal	ON – OFF
DOUBLE STROKE	It indicates the status of the double stroke	ON – OFF
START2	It indicates the status of the cycle 2 start signal	ON – OFF
TERM/FLUX	It indicates the status of the thermostat signal	ON – OFF
PRG RECALL 1	It indicates the status of the recall 1 signal	ON – OFF
PRG RECALL 2	It indicates the status of the recall 2 signal	ON – OFF
PRG RECALL 3	It indicates the status of the recall 3 signal	ON – OFF
PRG RECALL 4	It indicates the status of the recall 4 signal	ON – OFF
PRG RECALL 5	It indicates the status of the recall 5 signal	ON – OFF
SAFETY START 1	It indicates the status of the two-hand control push-button 1 signal	ON – OFF
SAFETY START 2	It indicates the status of the two-hand control push-button 2 signal	ON – OFF
(When the option Code 50200 is present)		
RESET DRESSING	It indicates the status of the accomplished electrodes dressing signal	ON – OFF
WELD / NO WELD	It indicates the status of the external weld / no weld signal	ON – OFF
RESET ERROR	It indicates the status of the errors clear signal	ON – OFF
RESET ELECTRODE	It indicates the status of the accomplished electrodes change signal	ON – OFF

The input status is represented as enabled (closed input with COM1) by means of the wording ON, while it is represented as disabled by means of the wording OFF.

2.11 - PROG. SEQUENCE

```
-TE553  VER. 1.50--
 PROGRAM COPY
 CHECK INPUT
>PROG. SEQUENCE
```

This menu includes the parameters required for activating the program sequence operations. In this WORKING 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.

```
  PROG. SEQUENCE
>STEP 1 PRG.     003
 STEP 1 WELDS     07
 STEP 2 PRG.     012
```

PROGRAM SEQUENCE MENU PARAMETERS TABLE

PARAMETER	PARAMETER DESCRIPTION	RANGE VALUE
STEP 1 PRG.	Program to be carried out in the step 1	000 – 250
STEP 1 WELDS	Number of spots to be carried out with step 1	01 – 25
STEP 2 PRG.	Program to be carried out in the step 2	001 – 250
STEP 2 WELDS	Number of spots to be carried out with step 2	00 – 25
STEP 3 PRG.	Program to be carried out in the step 3	001 – 250
STEP 3 WELDS	Number of spots to be carried out with step 3	00 – 25
STEP 4 PRG.	Program to be carried out in the step 4	001 – 250
STEP 4 WELDS	Number of spots to be carried out with step 4	00 – 25
STEP 5 PRG.	Program to be carried out in the step 5	001 – 250
STEP 5 WELDS	Number of spots to be carried out with step 5	00 – 25

STEP 1 PRG.
This parameter indicates the program number that the welder has to carry out and is always coupled with the STEP 1 WELDS parameter.
When this parameter is set to zero, the programs sequence is disabled.

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

STEP 2 PRG.
This parameter indicates the program number that the welder has to carry out and is always coupled with the STEP 2 WELDS parameter.

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

STEP 3 PRG.
This parameter indicates the program number that the welder has to carry out and is always coupled with the STEP 3 WELDS parameter.

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

STEP 4 PRG.
This parameter indicates the program number that the welder has to carry out and is always coupled with the STEP 4 WELDS parameter.

STEP 4 WELDS
The value of this parameter indicates the number of welds to be carried out with the program matched to the same step.

STEP 5 PRG.
This parameter indicates the program number that the welder has to carry out and is always coupled with the STEP 5 WELDS parameter.

STEP 5 WELDS
The value of this parameter indicates the number of welds to be carried out with the program matched to the same step.

After activating this operating mode and setting the parameters of the PROG. SEQUENCE menu as aforesaid, it is possible to start carrying the welding spots out. By turning the key on RUN position, the display will show the sequences data as per the below picture.

```
WELD N.008 TOTAL 013
PRG. N.003 RMS 10.45
TIME 10.0 SPOT 00050
NEXT 009 NEXTPRG 002
```

WELD N.008 TOTAL 013
It indicates the progressive number of the last carried out welding spot and the welding spots total number the sequence is composed of.

PRG. N.003 RMS 10.45
It indicates the program number and the RMS current value of the last welding spot.

TIME 10.0 SPOT 00050
It indicates the welding time of the last carried out program and the spots counter value.

NEXT 009 NEXTPRG 002
It indicates the progressive number of the next spot and the program to be carried out.

SEQUENCE EXAMPLE

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

PARAMETER	VALUE
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

At each cycle start signal, a welding spot is carried out with the welding program relevant to the actual step.

In this specific case, as shown by the below scheme, the following welding spots are carried out 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
STEPS	1	1	1	1	2	2	3	3	3	3	3	3	4
PRG.	03	03	03	03	07	07	11	11	11	11	11	11	04

This operating mode typology is usually applied to a manual welder, where the operator carries the welding spots out always in the same order but with different working parameters. This operating mode prevents the operator from manually changing the program and, therefore, from diverting his attention away from the piece to be welded, from changing the foot-pedal or other cycle start 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 an error occurs during the sequence process, the last weld or another weld may be repeated or you may continue avoiding certain spots. Always with the key switched to WORK position, use key ⊞ to increase the welds counter to the next spot or to the required spot otherwise use key ⊟ to go back one or more places in the spots to be carried out.

Display data		Display data after key
WELD N.006 TOTAL 013 PRG. N.007 RMS 10.45 TIME 12.5 SPOT 00050 NEXT 007 NEXTPRG 011	+	WELD N.007 TOTAL 013 PRG. N.011 RMS 09.57 TIME 12.5 SPOT 00057 NEXT 008 NEXTPRG 011
WELD N.013 TOTAL 013 PRG. N.004 RMS 05.00 TIME 12.5 SPOT 00065 NEXT 001 NEXTPRG 003	−	WELD N.012 TOTAL 013 PRG. N.011 RMS 07.50 TIME 12.5 SPOT 00073 NEXT 013 NEXTPRG 003

2.12 - TIP-DRESSING

The tip dressing function is the combination, in just one function, of the current linear stepper function coupled with the restoring of the electrodes original diameter.
The current stepper function allows compensating the electrodes wear which affects the welding quality. When the electrodes diameter increases also the contact section between the electrode and the piece to be welded increases. Consequently, the welding current density (Ampere/mm^2) decreases. In order to compensate this phenomenon, the current adjustment is gradually increased according to the electrodes diameter increase so to keep a constant current density.
The restoring of the electrodes original diameter is an operation which is usually carried out by means of a tool (dresser) allowing restoring the electrodes diameter, which worn out and increased during the production, to its initial working value.
If the same current adjustment is kept all along the electrodes life or if the electrodes diameter is never restored to its optimal value, the last carried out welding spots will have a lower quality than the first ones.
Usually, the tip dressing function allows interfacing the welding control unit with the dresser and may be used with automated equipment.

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

This menu allows programming the tip-dressing number to be carried out during the electrodes life.

```
  TIP-DRESSING
>DRESSING NUMBER  02
 SPOT DRESSING   003
 DRESSING STEPS  07%
```

This function is displayed only if the (optional) expansion card, code 50200, is installed on the control unit.

Before switching on the TE553 control unit with the supplementary expansion board item 50200, check that the inlet ELECTRODES END LIFE CLEAR (Pin 52) is not activated.
Otherwise, the 50200 board is not recognized by the control unit.

By enabling this function, the **STEPPER MENU** programming is disabled.

The parameters to be programmed for using the tip-dressing function are the following ones:

PARAMETER	PARAMETER DESCRIPTION	VALUE
DRESSING NUMBER	Number of tip-dressing to be carried out	00 - 99
SPOT DRESSING	Number of welding spots per tip-dressing	001 - 650
DRESSING STEPS	Stepper percentage per tip-dressing	01 - 50%
DRESSING ALARM	Notice welding spots number	00 – 40
ELECTRODES ALARM	Pre-alarm electrodes	01 – 40
DRESSING OFFSET	Tip-dressing current compensation	00 – 30%

Each time a value relevant to the tip-dressing is modified, the spots counter is cleared and the tip-dressing is recalculated from the beginning.

DRESSING NUMBER
This parameter indicates the number of tip-dressing to be carried out on the electrodes before these ones become useless.
If this parameter is set to zero, the tip-dressing is not carried out.

SPOT DRESSING
It indicates the number of welding spots per each tip-dressing. The product of this parameter multiplied by the tip-dressing number (see previous paragraph) indicates the maximum welding spots number the control unit carries out.

DRESSING STEPS
This parameter indicates the current stepper percentage to be achieved at the end of each tip-dressing.

DRESSING ALARM
This parameter indicates the warned welding spots number during which the ALARM DRESSING outlet is enabled for requiring the welding electrodes maintenance.
If, at the end of the pre-alarm welding spots, the control unit has not received the accomplished tip-dressing signal, it stops and displays the following message:

```
    ERR 0116
SPOTS FINISHED
DRESS ELECTRODES
```

In order to restore operations, first clear the screen via the ERROR RESET input followed by the activation of the signal that indicates that the dressing was done.

ELECTRODES ALARM
This parameter indicates the warning welding spots number during which the ELECTRODES ALARM output is enabled for requiring the replacement of the welding electrodes.
If, at the end of the pre-alarm welding spots, the control unit has not received the signal that indicates that the electrodes were replaced, it stops and displays the following message:

```
    ERR 0117
ELECTRODE END LIFE
REPLACE WITH NEW
```

In order to restore operations, first clear the screen via the ERROR RESET input followed by the activation of the signal that indicates that the electrodes were replaced.

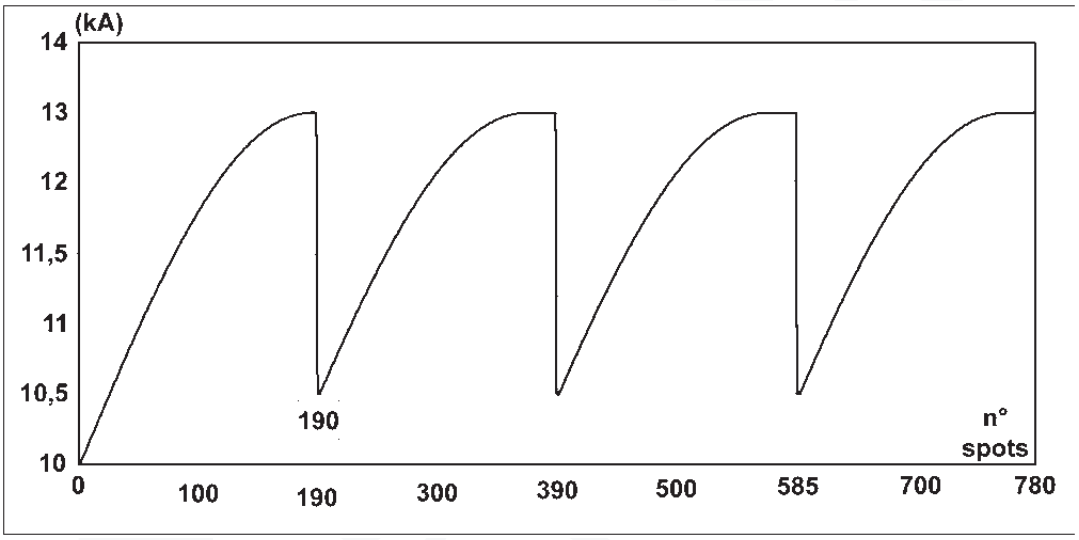
DRESSING OFFSET
Use this parameter to increase, in percentage, the starting value of the dressings welding current after the first one.

EXAMPLE:

The parameters outlined in the table below were set (with a set work program such as, for example, "WORKING MODE" IK) with an initial current value set to 10KA.

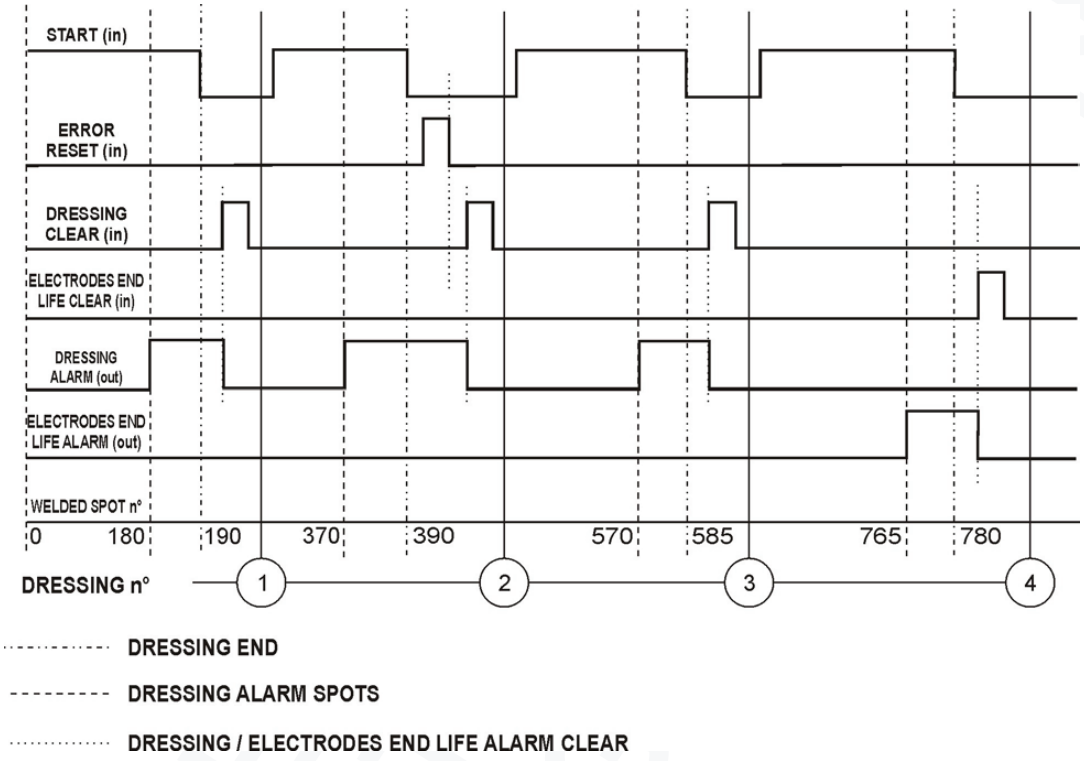
PARAMETER	VALUE
DRESSING NUMBER	3
SPOT DRESSING	200
DRESSING STEPS	30%
DRESSING ALARM	20
ELECTRODES ALARM	20
DRESSING OFFSET	5 %

The chart below shows the pattern of how the current increased during the electrodes dressing run mode.



Notice that the initial current of the first dressing starts at 10KA whilst a percentage is added to the starting current value of the subsequent dressings (parameter DRESSING OFFSET).

The chart below shows the time-study and modalities of the signals used for this operating mode (referring to the values in the foregoing table).



From the moment the control unit activates the DRESSING ALARM output, it may be reset at any time by activating the DRESSING CLEAR input as shown in the foregoing chart for dressings 1, 3 and 4.

In the example, the last DRESSING spot was reached for DRESSING n°2 without clearing the DRESSING ALARM. In this case the control unit stops and displays the relevant message (ERROR 116). In this case, first delete the screen from the control unit either using the ERROR RESET input or using the CLEAR key, and then clear the DRESSING ALARM output.

The same is applicable to clear the ELECTRODES END LIFE ALARM output.

When the ELECTRODES END LIFE CLEAR input signal is activated, the control unit resets the spots counter.

2.13 - THICKNESS SENSE

```
-TE553  VER. 1.50--
 CHECK INPUT
 SEQUENZE PROGRAM.
>THICKNESS SENSE
```

The visibility and accessibility of this menu depends on the activation (ON) of the THICK SENSOR parameter which is included in the FEATURES MENU. This is up to the user.

Inside the THICKNESS SENSE menu, there are contained the parameters for configuring the linear position sensor. Due to their importance, the access is protected by a password.

```
  CODICE ACCESSO
PER ENTRARE MENU
    - - - - -
```

In case the user is not authorized, meaning that the access password is unknown, then the following message is displayed:

```
  CODICE ERRATO
  RIPROVARE !
```

After entering the correct password, it is possible to modify the parameters of the sensor.

```
   THICKNESS SENSE
>LINEAR SENSOR   OFF
 SENSOR S/N_P1: 0000
 SENSOR S/N_P2: 0000
```

Should the position sensors be activated, then they are initialized whenever turning the control unit on. In case of initialization error, this is displayed on the control unit with the following message:

```
     LINEA CAN
 NON INIZIALIZZABILE
```

And the sensors are automatically disabled.

Therefore, it will be necessary to solve the problem of non-initialization, re-access the THICKNESS SENSE menu and manually re-enable the position sensors.

PARAMETER	PARAMETER DESCRIPTION	VALUE RANGE
LINEAR SENSOR	Enabling – disabling of the linear sensors	ON – OFF
SENSOR S/N_P1:	Part 1 serial sensor 1	XXXX
SENSOR S/N_P2:	Part 2 serial sensor 1	XXXX
SENSOR ID CAN:	ID CAN per sensor 1	100 – 119
DELAY IDENT.	Delay for indentation measurement	0 – 1000 mS

LINEAR SENSOR

It enables or disables the use of linear position sensors; in case of sensors initialization error, it automatically shifts on OFF. The sensors identification parameters are not erased.
By enabling the position sensors, there are made available the measurements relevant to the original thickness of the sheets to be welded and to the electrode penetration at the end of welding process as well as their relevant limits.

SENSOR S/N_P1:

It contains the first part of the linear sensor serial number. The serial number is readable on the sensor body.

SENSOR S/N_P2:

It contains the second part of the linear sensor serial number. The serial number is readable on the sensor body.

SENSOR ID CAN:

It allows setting the sensor identifier within the CAN network. In order to work properly, the sensors within the CAN network will need to have unique identifiers.

DELAY IDENT.

It specifies the delay in mS that the system must wait for once the welding current flow has terminated so to perform the measurement of the portion with which to derive the value of the electrode penetration during welding.
The procedure to be performed in order to adjust the DELAY IDENT. parameter is explained here below:

ADJUSTMENT OF THE DELAY IDENT. PARAMETER

During that welding phase in which there occurs a current flow, the machine mechanical frame may vibrate under the current electrodynamic action; the vibration induced by the current flow does not cease immediately at the end of the current flow. On the contrary, it may take some time to fade: this time depends on the elasticity of the spot welder frame. The performance of a quote measurement during this transition may be affected by the vibrations induced in the frame: it is, therefore, necessary to set a minimum delay, which may vary specifically according to the frame, so to be able to perform the quote measurements in a static situation.

How to determine the minimum waiting time before the performance of the measurement:

1) Configure the linear position sensor for using.
2) Set the parameter DELAY IDENT. to ZERO.
3) In the PROGRAM DATA menu, set the parameter QUALITY - T to ZERO in the program being used for welding. **Perform a spot in short-circuit so to carry out the quote zero (electrodes without material in between).**
4) In the PROGRAM DATA menu, set the parameter QUALITY - T to IDENT. in the program being used for welding.
5) **Perform a spot in short-circuit and observe the extent of the penetration (IDENTATION) provided on the TE553 control unit display at the end of the welding process.**

```
PRG 005   SPOT 01234

THICKNESS 00.000 mm
IDENTATION 0.000 mm
```

If the IDENTATION value remains equal to zero even after several welding spots, then the set delay is correct.

6) **If the displayed penetration value does not remain constant while running multiple welds, re-access the THICKNESS SENSE menu and increase the DELAY IDENT. parameter.**
7) Re-perform some welding spots as specified in paragraph 6.

2.14 – ADJUSTING THE FIRST INSERT DELAY

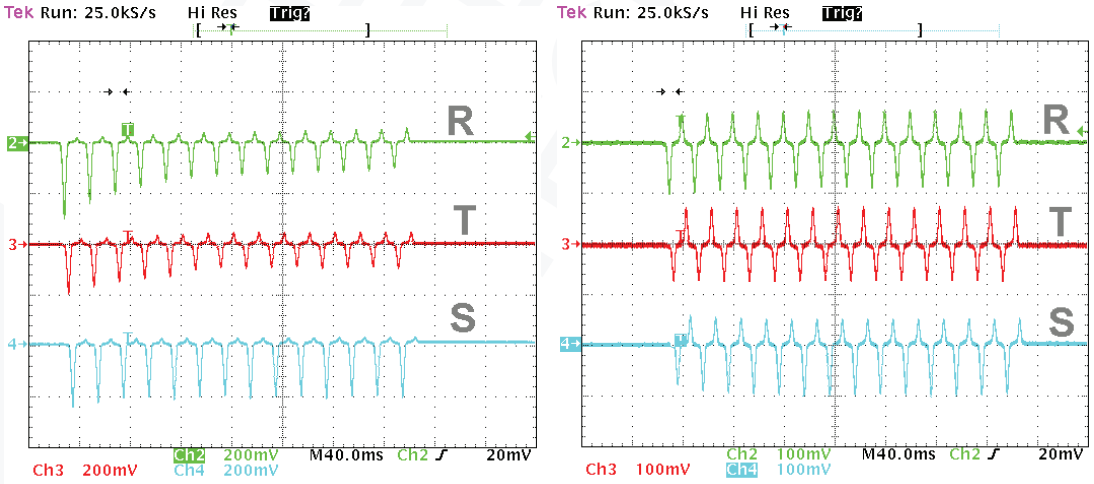
During **installation** it is compulsory to adjust the first insert delay to reduce power supply line absorption and to reduce the power dissipated at the transformer's primary current (risk of permanently damaging the welding transformer). This adjustment allows the user to optimize machine line absorption balance. In order to perform the adjustment, set the control unit to max power (POWER=99%) and carry out "idle" welds, interrupting the secondary circuit (e.g.: by placing insulating material between electrodes). Adjust the FIRST INSERT. parameter, in the **FEATURES MENU**, so that positive and negative line absorptions are balanced at every single phase.

Use an ammeter that measures the max positive and negative peak values in the three power supply lines at the input of the R, S, T spot welder.
The adjustment is correct when the positive peak value is similar to the negative one.

Use an appropriate current gauge having a CAT III 600V class of insulation and work by wearing specific insulated gloves when making interventions at powered lines.

In order to simplify the FIRST INSERT. adjustment, it is advisable to use an ammeter that shows the waveform on a digital oscilloscope. In this case carry out the adjustment so that all the primary current half-waves have the same amplitude.

The following graphs show the wave forms obtained through correct and wrong adjustments:



Unbalanced absorption

Balanced absorption

CHAPTER 3 - SEAM WELD MODE

```
    FEATURES MENU
 AUTORETAIN       ON
 DIODES CONSTANT OFF
>SEAM WELD MODE   ON
```

With parameter SEAM WELD MODE set to ON, the work screen is as follows:

```
PROG. 001 SPOT 12340
WELD CYCLE 10.0 ~
RMS CURRENT 032.6 kA
```

This function adapts the control unit to the requirements of a seam welder. As such, the welding current is supplied continuously or through the COLD 2 parameter in pulse mode.
The welding current is measured only during the WELD time, regardless of the programming, i.e. either pulse cycle or continuous cycle.
On keeping the cycle start command active, the control unit keeps repeating the time set in the WELD parameter. It is advisable to use short weld times to prevent the control unit from completing a long weld time on cutting off the cycle start command.
When running in seam weld mode, output SV3 is used as the roller start command instead of the forging one.
On selecting the seam weld function, the control unit may work either in WORKING MODE in FIX or in IK.

SEAM WELD MODE PARAMETERS TABLE

Below are displayed the possible 2 programming screens displayed according to the parameter selected in WORKING MODE. The screens contain all the programmable parameters.

```
   PROGRAM DATA
>PROGRAM N.     001
 WORKING MODE   FIX
 CONTROL MODE    NO
```

PARAMETER	RANGE VALUE
PROGRAM N.	001 - 250
WORKING MODE	FIX
CONTROL MODE *	NO
SQUEEZE 1	01 - 99 cycles
SQUEEZE	00 - 99 cycles
PRESSURE	00.5 – 10.0 bar
MOTOR DELAY	05 - 99 cycles
SLOPE UP	00 - 25 cycles
WELD	00.5 - 99.5 cycles
POWER	5 - 99 %
COLD 2	00 – 50 cycles
PRE-POWER	05 – 99 %
HOLD TIME	01 – 99 cycles
OFF TIME	00 – 99 cycles

CONTROL MODE *	CURR
CURR. MIN	0.5 - 90.0 kA
CURR. MAX	0.5 - 90.0 kA

The welding current set in the POWER 3 parameter is called by closing input REC5.

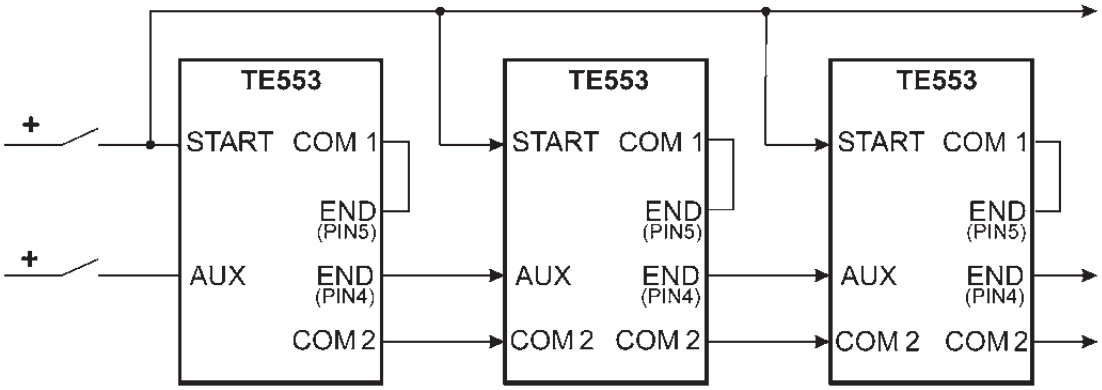
CHAPTER 4 - CASCADE OPERATING MODE

```
   FEATURES MENU
 DIODES CONSTANT OFF
 SEAM WELD MODE  OFF
>CASCADE MODE     ON
```

This function allows the cycle-end signal to be normally closed instead of normally open. As such, multiple TE553 control units may work in electrical cascade mode.

When two or more control units are connected to one another, the signals used to synchronize control units and carry out electrical cascade welds are as follows:
- START CYCLE input
- AUX input
- END CYCLE output

All the TE553 control units receive the cycle start signal simultaneously. Connect the END CYCLE signal to the AUX input of the next control unit. It is advisable to program parameter CASCADE MODE, of the last control unit, to OFF in order to use the END CYCLE signal with the normally open contact.

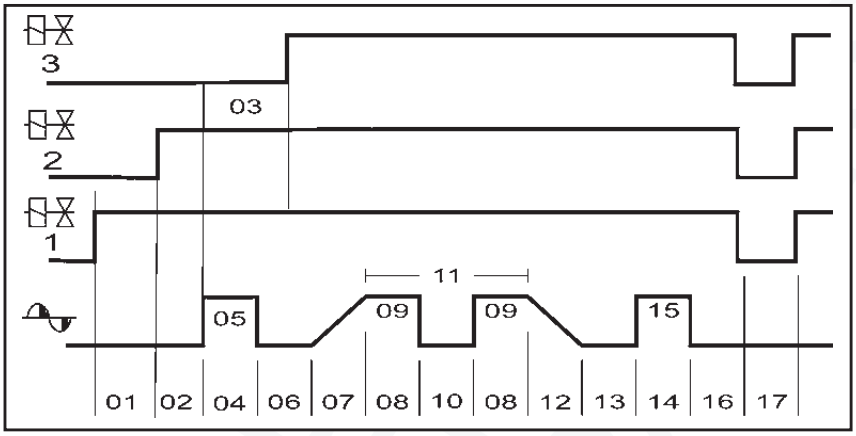


The cascade work mode excludes the possibility of using the control unit in SEAM WELD MODE.

CHAPTER 5 - DESCRIPTION OF THE WORK CYCLE

The work cycle carried out by the TE553 is described by adjusting the programming parameters. These parameters describe operating times and current adjustments that make up the work cycle when run in sequence.

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



The numbers below refer to the following types of parameters:

01	SQUEEZE 1 (SV1)	**10**	COLD 2
02	SQUEEZE (SV2) *	**11**	IMPULSE N.
03	FORGE DELAY (SV3) *	**12**	SLOPE DOWN *
04	PRE-WELD *	**13**	COLD 3 *
05	PRE-POWER *	**14**	POST-WELD *
06	COLD 1 *	**15**	POST-POWER *
07	SLOPE UP	**16**	HOLD TIME
08	WELD	**17**	OFF TIME
09	POWER		

Parameters marked by symbol * may either be enabled or disabled depending on which welder is used and the job it must perform.

For safety reasons, the microprocessor does not start the weld cycle if the cycle start signal is activated on turning-on the welder. Therefore simply release the control and then activate it again. Micro-cutoffs or excessive voltage drops do not alter the work mode but just stop the control unit. Just turn off the machine and then turn it on again to restore operations.

CHAPTER 6 - STOP BAD SPOTS

The machine may be stopped when a consecutive series of welds fall out of the regulated limits. The number of consecutive welds that causes the control unit to stop is regulated through parameter STOP BAD SPOTS in the **SETUP MENU** (for the programming directions, see the relevant paragraph).

```
      SETUP MENU
>STOP BAD SPOTS    01
 AMMETER CAP.   56 kA
 LANGUAGE          ITA
```

This value may vary from 0 to 15. When programmed to 0, the function is disabled and therefore the welder does not stop under any circumstance on exceeding set limits.

Please, notice that, in order to be effectively considered and counted, the "out-of-limits" welding spots must follow each other.

In addition to activating the function in the SETUP MENU, also enable the CONTROL MODE parameter relative to the current limits in the PROGRAM DATA menu.

```
     PROGRAM DATA
>CONTROL MODE     CUR
 SQUEEZE 1         25
 SQUEEZE           10
```

These parameters allow the user to keep the consistency of the welding current under control to help achieve constant quality results.

The control unit may work in the following control modes:

Welding current limits

Activate this mode by setting the CONTROL MODE parameter to CUR.
Two new parameters will be displayed:
CURR MIN lower current limit
CURR MAX higher current limit
These two parameters enable to set the welding current limit-values.

```
     PROGRAM DATA
>CONTROL MODE    CUR
 SQUEEZE 1        25
 SQUEEZE          10
```

```
     PROGRAM DATA
>OFF TIME          00
 MIN CURR.     10.0kA
 MAX CURR.     15.0kA
```

When the programmed condition occurs, the control unit stops and an error message is displayed. This message is associated with the error condition of the last run weld. In current control mode (CONTROL MODE = CUR), if the current value of the last weld is lower or higher than the values set in the foregoing parameters, one of the following messages is displayed:

```
    ERR 0106
  STOP LIMIT
 LOW CURRENT
```

```
    ERR 0107
  STOP LIMIT
 HIGH CURRENT
```

CHAPTER 7 - WELDS COUNTER FUNCTION

A counter has been built into the control unit to count the run welds. The max limit may be programmed. During operations, the counter's current value is displayed. The counter increases at each weld. The cycles carried out in NO WELD mode are not counted.

The welds counter may be cleared when the control unit is in work configuration.

```
PROG. 001 SPOT 12340
  WELD CYCLE 10.0 ~
CURRENT RMS 032.6 kA
```

then press the CLEAR key and the following message is displayed:

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

Press key [-] to clear the counter otherwise just wait 3 seconds and the control unit exits from the procedure without resetting the counter.
The maximum welds number is set by following the same procedure stated for the stepper function.
For example, if the user wishes the control unit to carry out 2840 welds and then stop, the following parameters are set in the **STEPPER MENU**:

```
     STEPPER MENU
>TOTAL STEPS      0
 SPOTS 1       2840
 INCREMENT 1     00
```

PARAMETER	PARAMETER DESCRIPTION	VALUE
TOTAL STEPS	Number of segments for stepper function	0
SPOTS 1	First segment spots number	2840
INCREMENT 1	Increase percentage of the first segment	0%

Further information about the parameters is supplied in the **STEPPER MENU** function paragraph.
When the counter reaches the set welds number, the control unit displays the following message:

```
      ERR 104
  MAX SPOTS NUMBER
```

and will not allow any other welds to be carried out until the counter is reset.

If parameter SPOTS 1 is set to zero, the stop function is disabled.

CHAPTER 8 - DESCRIPTION OF THE INTERFACE OUTPUTS

8.1 - WELD ERROR (WRONG)

The WRONG signal identifies a wrong weld which is out of the limits set conforming to the table shown below.

The WRONG output energizes also if the DIODES PROTECTION error occurs because the weld might have been interrupted before the elapsing of the set weld time.

The output, which is an opto-electronic contact, closes at the beginning of the hold time and remains closed until the end of the hold time (if the cycle start signal had already been deactivated), as long as the start button is held down or, if present, until the end of the pause time.

When an error message is displayed on the control unit, the wrong remains high until the error on the display is cleared by pressing the CLEAR key or through the DELETE ERRORS input (when additional card 50200 is present).

In WORKING MODE – FIX, the output may be energized by the current limits.
With CONTROL MODE = NO (inactive), the error output is never energized.

In WORKING MODE – ENE, the output may be energized by the current limits, by the minimum or maximum weld time, by the omission of the voltage signal and by exceeding the voltage signal (out of scale).
With CONTROL MODE = NO (inactive), the error output may be energized by the minimum or maximum weld time, by the omission of the voltage signal and by exceeding the voltage signal (out of scale).

WRONG SIGNAL ACTIVATION TABLE

WORKING MODE -► / CONTROL MODE ▼	FIX	ENE
NO	/	• Min time • Max time • VE out of scale • Error due to no electrodes voltage
CUR	• Minimum current limit • Maximum current limit	• Minimum current limit • Maximum current limit • Min time • Max time • VE out of scale • Error due to no electrodes voltage

QUALITY-T ▼	
THICK	• Minimum material original thickness limit • Maximum material original thickness limit
IDENT	• Minimum final indentation limit • Maximum final indentation limit

8.2 - END CYCLE

The END CYCLE signal indicates the end of the weld cycle. The output, which is an opto-electronic contact, closes at the end of the hold time and may last according to the following possibilities:

1. active until the cycle-start signal is present
2. active for 40 ms, if the cycle-start signal has already been deactivated
3. active for the entire OFF TIME if programmed to other than zero
4. active until any message or signal is deleted from the display

8.3 - LOCK

The LOCK signal indicates current activation during the weld cycle. The output, which is an opto-electronic contact, closes at the beginning of the weld time. It may also be the pre-weld or the rise of current, the duration of which entails all weld times and all the active current rising and dropping times.

CHAPTER 9 - SELECTING THE WORK PROGRAM THROUGH EXTERNAL RECALLS

The table below shows which inputs are required to call the work program. The selection is made through five inputs, suitably activated in the following combinations.

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 user may choose among 31 programs, when using input REC5 as additional recalling input, or 15 programs when using input REC5 as parity control. The use of input REC5 as parity control is activated in the **FEATURES MENU** (see specific paragraph), in which the user also chooses the type of parity, Even or Odd. The parity control consists in checking that the number of activated inputs, for calling a program, is even or odd.

Example.
Recall of Prog. N. 06 with odd 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.

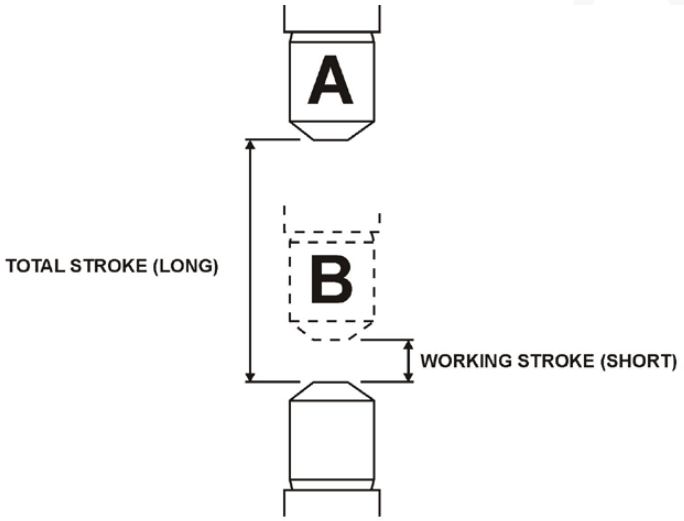
To properly recall the welding programs, either activate the direct recall inputs before the start cycle signal or simultaneously.

CHAPTER 10 - DOUBLE STROKE FUNCTION

In addition to the 3 solenoid valves that are part of the work cycle, the control unit manages a fourth solenoid valve aside from the work cycle to command the double stroke, which is also called the approach stroke.

⚠ The input (D.STROKE) enables the output of solenoid valve SV4, to control the DOUBLE STROKE, and keeps it enabled separately from the work cycle; the output remains enabled even when the WORK - PROGRAM key is switched to PROGRAM position.

On turning on the machine, with input (D.STROKE) active, the output is disabled. In this case, during the first weld the control unit first activates SV4 before the work cycle (this solenoid valve moves the electrode from position "A" to position "B"). It then carries out the programmed weld cycle after a fixed time of 0.6 seconds. At the end of the weld, SV4 does not deactivate and the electrode remains in position "B" as shown in the figure below.



A - MOVABLE ELECTRODE POSITION WHEN THE DOUBLE STROKE IS DISABLED (LONG STROKE)
B - MOVABLE ELECTRODE POSITION WHEN THE DOUBLE STROKE IS ACTIVATED (SHORT STROKE)

Later on, by keeping the input activated (D.STROKE), the work cycles will be carried out starting from position B.

In order to disable the SV4 double stroke output, simply deactivate the input (D.STROKE); the output will be disabled at the end of the cycle only if the input is deactivated during the weld cycle.

If the input is enabled during the weld cycle, the output will be enabled only on issuing the next cycle-start command.

CHAPTER 11 - OPTIONS

11.1 - RS-232 SERIAL INTERFACE

The RS-232 serial expansion card, code 50214, permits the user to connect the TE553 to a printer or a personal computer which must be fitted with a RS232 serial interface card, to document production data. The card interfaces with the control unit through a 6-pin connector and with the printer (or computer) through a standard female 9-pin connector. The 9-pin connector is wired as follows:

PIN 2	TRANSMISSION (TD)
PIN 3	RECEPTION (RD)
PIN 4	DTR (ALWAYS ON)
PIN 5	MASS (SIGNAL GROUND)
PIN 6	DSR (ALWAYS ON)
PIN 7	RTS
PIN 8	CTS

For the connection with a 9-pin port of a PC, simply use a standard modem cable, i.e. do not cross wires 2 and 3.
On connecting the control unit to a serial printer with a 25-pin connector, keep in mind that the serial ports of the printers have the following pin configuration:

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

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

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

The control unit runs the transmission at the beginning of the OFF TIME. It is important to point out that the time required to print data is approximately 20 ms and this time will be added to the set OFF TIME.

A specific parameter, in the special functions menu, allows the user to choose whether or not to activate the print. The following data is printed for each weld:

- Welding program number
- Number of cycles with which the weld was carried out
- Welding current
- Progressive spot number
- Measured energy value (only in WORKING MODE = ENE)
- Out-of-limit spot signal
- Interposed material thickness (optional)
- Electrode penetration within the interposed material (optional)

The control unit prints the heading and the value of the parameters of the selected program, when turned on and each time the key selector is switched from PROGRAM to RUN position.

Example of data printed during the welding (WORKING MODE = FIX):

PROG	CYCLES	CURRENT	ENERGY	SPOTS	LIMIT	THICK	IDENT
001	10,0	008.0	00000	00001	-----	00.000	0.000
001	10,0	007.9	00000	00002	-----	00.000	0.000
001	10,0	007.9	00000	00003	-----	00.000	0.000
001	10,0	007.9	00000	00004	-----	00.000	0.000

Example of data printed during the welding in CONTROL MODE = CUR:

PROG	CYCLES	CURRENT	ENERGY	SPOTS	LIMIT	THICK	IDENT
001	10,0	006.0	00000	00009	CUR OK	00.000	0.000
001	10,0	006.0	00000	00010	CUR OK	00.000	0.000
001	10,0	006.0	00000	00012	CUR MIN	00.000	0.000
001	10,0	006.0	00000	00013	CUR MIN	00.000	0.000
001	10,0	006.0	00000	00014	CUR MAX	00.000	0.000
001	10,0	006.0	00000	00015	CUR MAX	00.000	0.000
001	10,0	006.0	00000	00016	CUR MAX	00.000	0.000

Print example of the work program parameters values:

TE553 WELD CONTROL UNIT REV. 1.50

PROGRAM N.	001
WORKING MODE	FIX
CONTROL MODE	NO
SQUEEZE 1	10
SQUEEZE	20
PRESSURE	bar 05.0
FORGE DELAY	00
FORGE PRESS.	bar 07.0
PRE-WELD	00.0
PRE-POWER	% 05
COLD 1	00
SLOPE UP	00
WELD	05.0
POWER	% 20
IMPULSE N.	01
COLD 2	01
SLOPE DOWN	00
COLD 3	00
POST-WELD	00.0
POST-POWER	% 05
HOLD TIME	10
OFF TIME	00

11.2 - RS-485 SERIAL INTERFACE

The RS-485 serial expansion card, code 50209, permits connecting the control unit in the network to other welding control units and to a central personal computer for programming the control unit or for documenting production data. The card interfaces with the control unit through a 6-pin connector, and with the outside network, through a standard male 9-pin connector with the following signals:

PIN 1	Ground
PIN 2	Y (TX+)
PIN 3	A (RX+)
PIN 4	R1A
PIN 5	R2A
PIN 6	Z (TX-)
PIN 7	B (RX-)
PIN 8	R1B
PIN 9	R2B

The card may be connected only when the control unit is powered-off. Moreover, it is advisable to connect the six-pin connector first (the one that connects the welding control unit) followed by the RS485 connection. Then power-on the control unit and activate function **NET/485** in the **FEATURES MENU**.
During network communication, the welding control unit (slave) must be assigned with an identifying address to be recognized by a Master, for example a Personal Computer. Even this parameter, called NET ADDRESS, is set in the **FEATURES MENU**.
A personal computer software is available to manage data and communications among the control units connected in the network. The name of said software is **"TECNANet"** and it allows the user to check the structure of the network i.e. how many and which control units a re connected. It is also designed to run all the remote programming functions on each control unit as well as acquire and save production data.

The interface is isolated up to 1500V, without the need for any external power supply and works as a connection with standard RS485 signals in half duplex or full duplex mode. The male D-sub nine-pin connector has two screws with 4-40 UNC threading that also have a threaded head. These screws will be used for wall-mounting purposes (max 3mm) and for locking the mobile connector. The card is fitted with a protective black cap that protects it from dust and electrostatic charges. It is advisable to always leave this cap on the card's connector when the interface is not used.

The cards are fitted with termination resistances to be connected only to the first and last network connector. Do not forget to connect the ground wire among the various devices connected to the network.
The cable that connects the devices must not be longer than 1200 m, it must be shielded and have metallic or metallized connecting connectors. We recommend using Belden 8777 cable at 24 AWG with "Phoenix" "SUBCON 9/F – SH" type connectors.

11.3 - INTERFACE FOR PROPORTIONAL VALVE

This interface card, code 50220, permits the control unit to control a proportional valve and set the welding pressure in bars as one of the program's parameters. This interface requires external power supply. The 12-pole terminal strip permits the connection of the proportional valve, the control unit and the interface power supply.

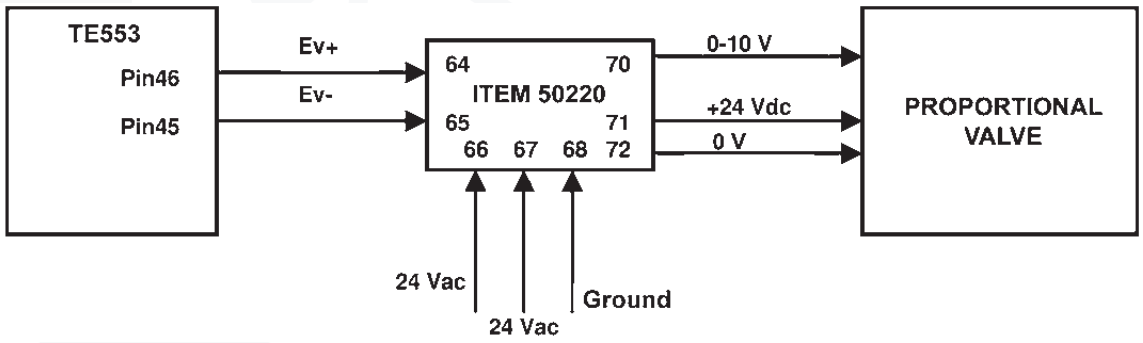
TERMINAL STRIP CONNECTIONS	
64	SV+ from the control unit (PIN 46)
65	SV- from the control unit (PIN 45)
66	24Vac
67	24Vac
68	Ground
69	OUT-I
70	0-10Vdc to the proportional SV
71	+24Vdc to the proportional SV
72	Ground to the proportional SV
73	ALARM-IN
74	ALARM1 (PIN 33- AUX3)
75	ALARM2 (PIN 34- COM1)

The user may program the control voltage range of the proportional valve directly via the welding control unit. The **FEATURES MENU** contains parameter PRESSURE RATIO with which to choose the most suitable **bar/Volt** ratio according to the solenoid valve to be used.

Example:

PRESSURE Parameter (bar)	PRESSURE RATIO Parameter (bar/Volt)	Output Volt
5.0	1.0	5
5.0	2.0	2.5
5.0	0.5	10

CONNECTIONS DIAGRAM: PROPORTIONAL VALVE



N.B.:

_ The card is fitted with a red LED, indicated by acronym D10 (adjacent to the relay), which indicates when +24VDC is present (Pin 71) and leads to the proportional valve. If the LED is off when power is ON, the user must check for the correct 24VAC (Pin 66 and Pin 67) and ground (Pin 68) connections.

_ The card is also fitted with a small trimmer, for adjusting the full scale of the output in voltage (Pin 70). This adjustment is carried out when tested and therefore MUST NEVER be moved away from its natural position so as not to alter the signal in the output.

CHAPTER 12 - DESCRIPTION OF SIGNALS ON TERMINAL STRIP

PIN	NAME	DESCRIPTION
1 *3*	**VAC**	This is the power supply of the control unit, which must be 24VAC. The power supply transformer must be of at least 50VA and must power the control unit only, to prevent any sources of interference.
2	**GND**	Ground connection. **Pay attention not to invert the wire with VAC (1-3) as this could damage the control unit's fuses.**
4 *5*	**LOCK- / END-** **LOCK+ / END+**	This output is a polarized opto-electronic switch, Max 30VDC/10mA, and is used to warn the user when a cycle ends if END CYCLE is selected; when in LOCKED state, the control unit supplies a signal at output from the beginning of the weld up to the hold.
6 *7*	**WRONG -** **WRONG +**	This output is a polarized opto-electronic switch, Max 30VDC/10mA, and closes if the set current limits are not met. The contact remains closed for the HOLD and OFF time. In order to acknowledge all the signal activation cases, please, refer to the relevant paragraphs.
8	**COM2**	Common for outputs with 0V reference. Connected to GND conforming to regulation EN60204.
9	**COM2**	Common for outputs with 0V reference. Connected to GND conforming to regulation EN60204.
10	**TRIGGER**	Output of the SCR switch-on command. This output is a rectangular wave, amplitude of approximately 30V on a load of 35Ω. The user must use trigger modules manufactured by TECNA with opto-isolators.
11	**COM1**	Common for inputs with 24VDC reference.
12	**REC5**	This input is closed on COM1, features **different** functions according to the selections made in the **FEATURES MENU**. The first function is either the external call or the parity control (see relevant chapter). If the TE553 is set to SEAM WELD mode, this input calls the second welding current (POWER 3 parameter).
13 *14* *15* *16*	**REC4** **REC3** **REC2** **REC1**	These inputs are used for directly calling welding programs from the outside. In order to call the programs correctly, these inputs must be enabled before the cycle-start signal. Inputs are active when closed towards the common COM1.
17	**COM1**	Common for inputs with 24VDC reference.
18	**AUX2**	This input allows an external device to stop the weld cycle during the squeeze stage. It may be used as interlocking input or to connect safety devices such as, for instance, flow meters or pressure switches. The contact connected to it must be the normally open type and activates closed on COM1.
19	**START2 NO**	To be connected to the microswitches of the cycle-start pedal. START2 determines the beginning of the work cycle of the second program selected during the programming phase. This input is active closed on the common COM1.
20	**START2 NC**	Currently this input is not used.
21	**COM1**	Common for inputs with 24VDC reference.
22	**AUX**	This input allows an external device to stop the weld cycle during the squeeze stage. It may be used as interlocking input or to connect safety devices such as, for instance, flow meters or pressure switches. The contact connected to it must be the normally open type and activates closed on COM1.
23	**START NO**	To be connected to the microswitches of the cycle-start pedal. START determines the beginning of the work cycle. This input is active closed on the common COM1.
24	**START NC**	Currently this input is not used.
25	**BIC1 NO**	This input may be connected to the manual cycle-start buttons. The weld cycle begins when BIC1 NO and BIC2 NO close simultaneously, or in sequence within a max time of 0.5 seconds.

26	**BIC1 NC**	Currently this input is not used.
27	**D. STROKE**	This input is used to manually control the double stroke in welders fitted with this function.
28	**BIC2 NC**	Currently this input is not used.
29	**COM1**	Common for inputs with 24VDC reference.
30 *31*	**TERM** **FLUX/TERM**	This input is used to connect a thermostat (pin 30). If a flow meter is also present, it must be connected in series with the thermostat, i.e. the thermostat with pin 30-31 and the flow meter with pin 31-32.
32	**COM1**	Common for inputs with 24VDC reference.
33	**AUX3**	This input allows an external device to stop the welding cycle during the squeeze stage. It may be used as a lock input or to connect safety devices such as, for instance, flow meters or pressure switches. The contact connected to it must be the Normally Open type and energizes when closed on COM1. When this input energizes, a message is displayed on the control unit.
34	**COM1**	Common for inputs with 24VDC reference.
35	**BIC2 NO**	Input for manual cycle-start buttons. The weld cycle begins when BIC1 NO and BIC2 NO close simultaneously, or in sequence within a max time of 0.5 seconds.
36	**COM1**	Common for inputs with 24VDC reference.
37	**VAUX**	This is a 24VDC output and indicates that the control unit is powered-on and ready to receive a cycle-start command. This output may be used to connect a valve intended for the welder's supplementary services. Command suitable for coil control at 24VDC. Max. 5W.
38	**SV1**	Connect to the solenoid valve that actuates the main cycle. Command suitable for coil control at 24VDC. Max 5W.
39	**COM2**	Common for outputs with 0V reference. Connected to GND conforming to regulation EN60204.
40	**SV2**	Connect to solenoid valve 2 (BACK PRESSURE). Command suitable for coil control at 24VDC. Max 5W.
41	**COM2**	Common for outputs with 0V reference. Connected to GND conforming to regulation EN60204.
42	**SV3**	Connect to solenoid valve 3 (FORGE). Command suitable for coil control at 24VDC. Max 5W.
43	**COM2**	Common for outputs with 0V reference. Connected to GND conforming to regulation EN60204.
44	**SV4**	Connect to solenoid valve 4 (DOUBLE STROKE). Command suitable for coil control at 24VDC. Max 5W.
45 *46*	**SV PROP-** **SV PROP+**	This is an output for the connection with the card that controls the proportional valve.
47 *48*	**EMERGENCY** **EMERGENCY**	Emergency input. An emergency button may be connected to these inputs, the contacts of which must open if a fault occurs. The emergency procedure and consequently the opening of these inputs cutoff voltage to all outputs.
49 *50*	**ROG** **AGND**	The current transducer (or Rogowski loop) must be connected to this analogue input.
51	**SHIELD**	Shield for transducer cable.

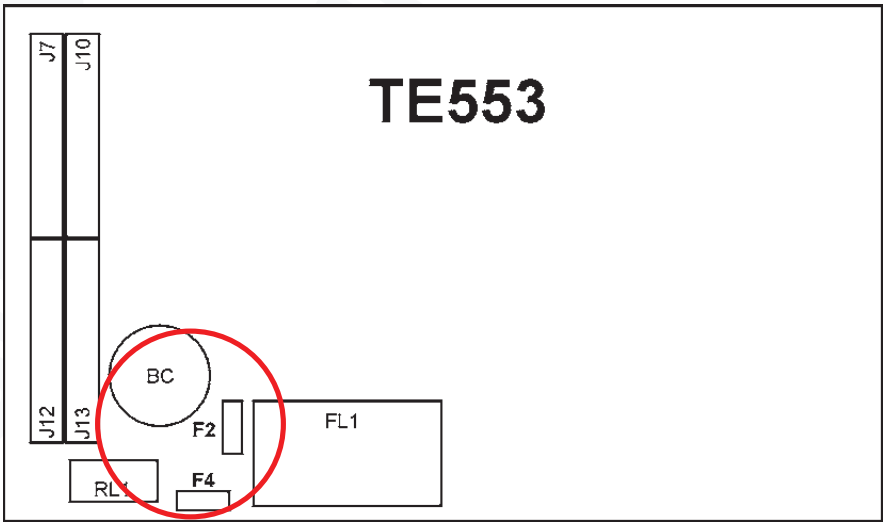
12.1 - DESCRIPTION OF THE SIGNALS ON THE OPTIONAL BOARD 50200

52	**ELECTRODES END LIFE CLEAR**	This input clears the ELECTRODES END LIFE ALARM output and it is active closed on the common COM1.
53	**DRESSING CLEAR**	This input clears the DRESSING ALARM output and it is active closed on the common COM1.
54	**WELD/NO WELD**	Input for enabling/disabling the weld. The command works in series with the button on the control unit's keypad. If using only the weld/no weld via the keypad, this input must be connected to the COM1 present on card TE553.
55	**ERROR RESET**	This input is to be used to delete displayed error messages and it is active closed on the common COM1.
56	**GND**	Ground.
57	**COM2**	**To be connected with COM2 present on card TE553.** Connected to GND conforming to regulation EN60204.
58 *59*	**VE** **VE**	This input acquires the secondary voltage and works only with the electrodes voltage acquisition module.
60 *61*	**DRESSING ALARM**	This output warns that the dressing pre-alarm weld spots number has been attained.
62 *63*	**ELECTRODES END LIFE ALARM**	This output indicates that the pre-alarm weld spots number (associated with the electrode's life end) has been reached.

Before switching on the TE553 control unit with the supplementary expansion board item 50200, check that the inlet ELECTRODES END LIFE CLEAR (Pin 52) is not activated.
Otherwise, the 50200 board is not recognized by the control unit.

NOTES:
Components **"F2"** and **"F4",** located on the control unit connector's side, are delay fuses, which cannot be reset and that withstand a max current of 3.5 A each. If the ON warning light does not turn on, check the state of the foregoing components.
The fuses used are "*LITTELFUSE*" 47303.5 Tecna article, Code 21954.

Component **"BC"** stands for the two-position PROGRAM - RUN key lock installed on the control unit's front panel, traced as code "RS" 321054 or as a Tecna article, Code 21955.



CHAPTER 13 - LIST OF TE553 MESSAGES

13.1 - SYSTEM ERRORS

MESSAGE	N°	CAUSE	REMEDY
ERROR RELE1 OPEN ERROR RELE1 OPEN	*1*	An error occurred in the electronic component that activates the outputs. The state of relay 1 is off, therefore faulty. This is why the outputs cannot be enabled.	Contact service centre.
ERROR RELE1 CLOSED ERROR RELE1 CLOSED	*2*	An error occurred in the electronic component that activates the outputs. The state of relay 1 is on, therefore faulty. This is why the outputs cannot be enabled.	Contact service centre.
ERROR RELE2 OPEN ERROR RELE2 OPEN	*3*	An error occurred in the electronic component that activates the outputs. The state of relay 2 is off, therefore faulty. This is why the outputs cannot be enabled.	Contact service centre.
ERROR RELE2 CLOSED ERROR RELE2 CLOSED	*4*	An error occurred in the electronic component that activates the outputs. The state of relay 2 is on, therefore faulty. This is why the outputs cannot be enabled.	Contact service centre.
BOTH INSIDE RELAYS ARE FAULTY	*5*	Errors occurred in both electronic components that activate the outputs. This is why the outputs cannot be enabled.	Contact service centre.
CRC INSIDE MEMORY CRC INSIDE MEMORY	*6*	An integrity error occurred in the data stored in the control unit's Eprom. This ensued from the checksum calculation on the data in this memory.	Contact service centre.
FAULT/MISSING MAINS SYNCHRONISM	*7*	A "synchronism" error occurred due to the temporary omission of the power line reference signal or to line interference.	Clear the error and check the working efficiency of the devices that cutoff the power line and check for any interference.
SUPPLY FREQUENCY OUT OF LIMITS 50-60	*8*	The control unit did not succeed in measuring a steady mains frequency between 50 and 60 Hz.	Try to turn on the control unit again and check that power supply is 24 VAC with a frequency of 50 or 60 Hz.
OUTPUT VALVES IN SHORT CIRCUIT	*9*	One of the outputs of the solenoid valves is short circuited.	Check the electrical connections of the control unit. Check the solenoid valve coils.

13.2 - WORK ERRORS

MESSAGE	N°	CAUSE	REMEDY
NO EMERGENCY ERROR OR RELE RESTART ERR	*101*	The emergency signal required to run the control unit was omitted or a relay error occurred when the restart relay was activated.	Carefully check the electrical connections of the emergency signal.
THERMOSTAT OR FLOWSWITCH ERROR	*102*	Either the protective thermostat or the flow meter inside the welder tripped.	Check that enough water circulates inside the welder and/or check the working efficiency of the thermostat.
MAX SPOTS NUMBER	*104*	The weld spots counter has attained the max set limit for replacing the electrodes.	Clear the welds counter; refer to relevant chapter.
STOP LIMIT LOW CURRENT	*106*	A certain number of welds were run out of the set limits. The last weld was carried out with a current value lower than the minimum set limit.	Clear the error as outlined.
STOP LIMIT HIGH CURRENT	*107*	A certain number of welds were run out of the set limits. The last weld was carried out with a current value higher than the maximum set limit.	Clear the error as outlined.
REACHED ENERGY WITHIN MIN TIME	*110*	Energy required during the weld was attained within the minimum welding time.	Clear the error as outlined and check the program to change certain parameters such as ENERGY, POWER and WELD.
NO REACHED ENERGY WITHIN MAX TIME	*111*	The energy that the control unit has read during the welding is less than the programmed one.	Clear the error as outlined and check the program to change certain parameters such as ENERGY, POWER and WELD.
NO SIGNAL CURRENT ERROR	*112*	During the last weld cycle there was no secondary current circulation.	Select, if possible, the lower ammeter rate. Check for the correct connection and position of the current transducer.
NO ELECTRODES VOLTAGE ERROR	*113*	During a work cycle in CONTROL MODE ENE, no electrode voltage signal was detected.	Check the connection of the wires at the weld transformer's secondary and the rating set on the acquisition module.
ERROR CURRENT OVERFLOW	*114*	A weld was carried out with a current signal that was too high.	Select, if possible, the higher ammeter rate. Check for the correct connection and position of the current transducer.

VOLTAGE ERROR OVERFLOW	***115***	An overrun occurred during the last welding cycle with regard to the electrodes' upper voltage limit. It is advisable to change the voltage rating on the acquisition module.	Check the connection of the wires at the weld transformer's secondary and the rating set on the acquisition module.
SPOTS FINISHED DRESS ELECTRODES	***116***	The maximum number of welds was attained without having cleared the DRESSINGS ALARM output.	Clear the error, carry out the electrodes dressing procedure and then activate the dressing-done signal.
ELECTRODES FINISHED REPLACE WITH NEW	***117***	The maximum number of welds was attained without having cleared the ELECTRODES END LIFE ALARM output.	Clear the error, change the electrodes and then activate the change-done signal.
START RELEASED! SPOT NOT FINISHED	***118***	With parameter AUTORETAIN set to OFF, the cycle-start signal was issued before the weld ended.	Clear the error to continue.
DIODE PROTECTION ON - REDUCE T OR I	***119***	The supplied current is too high or the weld time is too long for the number if diodes present on the transformer.	Reduce the current or the welding time.
<<INPUT AUX3 ON>>	***120***	The AUX3 input signal (Pin 33) is energized.	Check the output of the card that controls the proportional valve or the card that triplicates SCR triggers, code 50117. This message clears when contact AUX3 reopens of on releasing the cycle start signal.
POSITION SENSOR ZERO PROCEDURE	***121***	The QUALITY - T function has been enabled in a welding program but the quote zero procedure has not been carried out.	Set the parameter QUALITY - T to ZERO and perform a weld without material between the electrodes so to determine the ZERO quote. Subsequently, restore the original value of the QUALITY-T parameter.
POSITION SENSOR QUOTE FAIL	***122***	Error in the calculation of the position sensor quote extent.	Make sure that the sensor is supplied and that the cable is properly fitted. Contact service centre.
POSITION ERROR MODIFIED STRUCTURE	***123***	Position sensor error when measuring the quote. Excessive wear of the electrode or change of the welder frame geometry.	Check that there are no abnormal movements in the welder frame. Clear the error and repeat the zero quote procedure.
POSITION SENSOR FAIL COMUNICATION	***124***	Communication error with the position sensor.	Check the correct wiring of the position sensor. Contact service centre.
POSITION SENSOR NOT PROGRAMMABLE	***125***	The CAN board item 50274 was not detected when powering.	Check for the correct connection of the CAN board with the TE553 control unit.

THICKNESS UNDER LOW LIMIT	***126***	Original thickness of the metal sheets between the electrodes lower than what set in the THICK. MIN. limit.	Clear the error and check the material between the electrodes.
THICKNESS OVER HIGH LIMIT	***127***	Original thickness of the metal sheets between the electrodes greater than what set in the THICK. MAX. limit.	Clear the error and check the material between the electrodes.
IDENTATION UNDER LOW LIMIT	***128***	Indentation of the metal sheets between the electrodes lower than what set in the IDENT. MIN. limit.	Clear the error and check the material between the electrodes.
IDENTATION OVER HIGH LIMIT	***129***	Indentation of the metal sheets between the electrodes greater than what set in the IDENT. MAX. limit.	Clear the error and check the material between the electrodes.
POSITION SENSOR NOT FOUND	***130***	It is being used a welding program requiring the presence of position sensors but they do not appear to be present.	Check the welding program being used: if the QUALITY-T function is set, then disable it.

13.3 - PROGRAMMING ERRORS

MESSAGE	N°	CAUSE	REMEDY
WORKING MODE ENE MIN TIME > MAX	200	During a work cycle in CONTROL MODE ENE, the minimum weld time is higher than the maximum weld time.	Modify the parameter that triggered the error.
CURRENT MIN LIMIT > CURRENT MAX LIMIT	201	The value set in CURR MIN is higher than the value set in CURR MAX.	Modify the parameter that triggered the error.
TOTAL PULSE WELDS > WELD MAX TIME	203	The number of impulses IMPULSE N. multiplied by the WELD time makes up a number of cycles higher than the maximum admissible number.	Modify the parameter that triggered the error.
NOT PROGRAMMABLE TIP-DRESS. ENABLED	204	The user attempted to enter the STEPPER MENU while the TIP-DRESSING function was active. This situation is incompatible.	Deactivate the TIP-DRESSING function to activate the STEPPER MENU function.
NOT PROGRAMMABLE STEPPER ENABLED	205	The user attempted to enter the TIP-DRESSING MENU while the STEPPER MENU function was active. This situation is incompatible.	Deactivate the STEPPER MENU function to activate the TIP-DRESSING function.
CURRENT PARAMETER HIGHER THAN RANGE	206	The required work program contains the CURRENT parameter the value of which is higher than the AMMETER CAP parameter.	Modify the parameter that triggered the error.
OFFSET DRESSING % HIGHER THAN STEPPER	207	The DRESSING OFFSET parameter is higher than the required DRESSING STEPS increment value.	Modify the parameter that triggered the error.
CURRENT MAX LIMIT HIGHER THAN RANGE	208	The required work program contains the CURR. MAX parameter the value of which is higher than the AMMETER CAP parameter.	Modify the parameter that triggered the error.
THICKNESS MIN LIMIT > THICK MAX LIMIT	209	The value set in THICK. MIN is greater than the one set in THICK. MAX.	Change the parameter that caused the error.
IDENT MIN LIMIT > IDENT MAX LIMIT	210	The value set in IDENT. MIN is greater than the one set in IDENT. MAX.	Change the parameter that caused the error.

CHAPTER 14 – TECHNICAL SPECIFICATIONS

POWER SUPPLY: 24VAC +/- 10%

FREQUENCY: 50/60Hz +/- 1%

CONSUMPTION: 0.3A WITHOUT LOAD / 2A WITH COMPLETE LOADS

MAX ALTITUDE: 1000m

RELATIVE HUMIDITY: from 40% to 80%

WORK TEMPERATURE: 0°C to 50°C / 32°F to 122°F

WEIGHT: 530g / 1.1685 lb

PROTECTION RATING: IP40

NOTES

NOTES

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