TECNA DIRECT.COM

Industrial Resistance Welders and Tool Balancers

WELDING CONTROL UNIT

INSTRUCTION MANUAL

TE470/TE480

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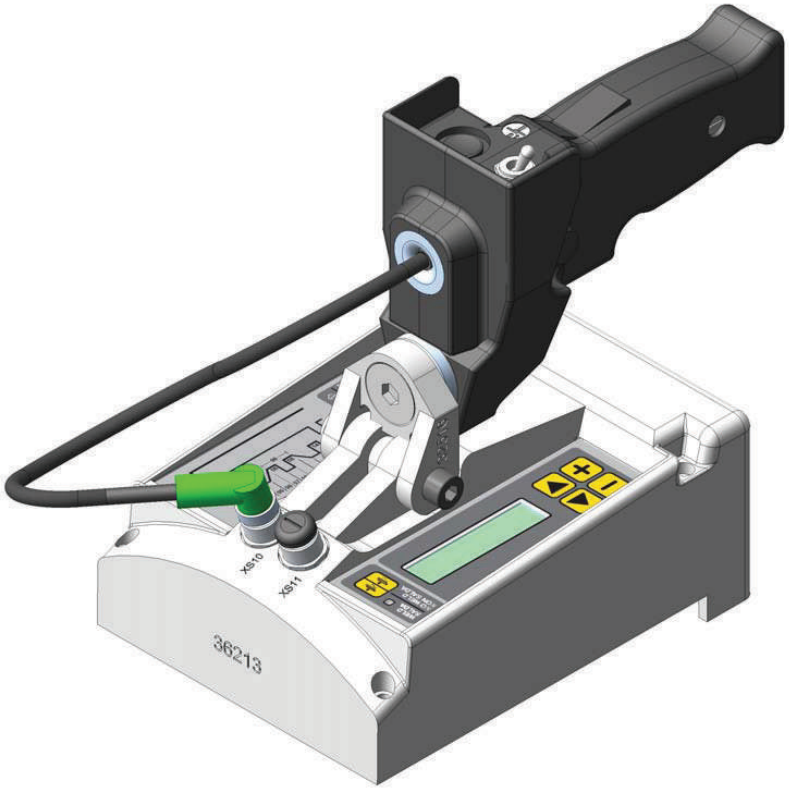
CHAPTER 1 – THE TE470/TE480 WELD CONTROL UNIT

The TE470/TE480 is a microprocessor-based weld control unit for suspended, single-phase resistance welding guns. The task of this weld control unit is to manage the welder's components, especially the controlled diodes that adjust the welding current. The special feature of this control unit is that it is fitted with specific functions, when used with industrial welders, such as the double stroke control and the safeties efficiency check function that, if installed, is present on the handle. The handle is not an integral part of the control unit since different types of handles are used to adapt the machine to different work needs.

As many as 63 different weld programmes can be stored.
Depending on the type of handle connected to the control unit, from 2 to 4 programmes can be called from the outside.
Each program consists of programmable parameters that describe the work cycle. In addition to the simple 4-stroke cycle, the control unit enables the execution of welds with pre-weld, post-weld, slope and pulse current.

The TE470 can operate in conventional mode and constant current while the TE480 can work also in constant energy mode.

Both control units display the welding current and envisage a control on the output current with settable limits.



1.1 – MAIN FEATURES

- Simplified programming by means of 5 push-buttons and LCD alphanumeric display.
- Synchronous controlled diodes command, adjustment of the phase control current.
- Possibility of connecting 2 handles.
- Storage of 63 weld programmes, 2 called through the switch on the handle (or 4 through the commutator).
- Up to 22 programmable parameters for each program.
- Current ascent, current descent, impulses, pre-weld and post-weld functions.
- Welding times adjustment in half-periods.
- Display of the RMS welding current measurement in kA and relative angle of conduction.
- 3 operating modes: conventional, constant current and constant energy (only TE480).
- Either welding current or conductor angle limits.
- Automatic double stroke function (to be employed only when the welder has been designed for this function).
- Stepper function to balance the electrodes wear-out with adjustable curve.
- Welds counter.
- Single and automatic cycle. WELD/NO WELD function.
- Delay of first phase shift adjustment to get the best balance of the machine absorption from mains.
- Management of 2 solenoid valves 24 VDC, Max 3.5 W, with output protected against short circuits: electrodes-closing valve and double-stroke valve.
- Self-adjustment to the mains frequency 50/60 Hz.
- Output for managing a proportional solenoid valve.
- Cycle-end output.
- Selectable languages: Italian, English, Spanish, German, French, Hungarian, Portuguese and Swedish.

1.2 – COMMANDS ON THE PANEL

▲	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.
WELD SALDA / NO WELD NON SALDA	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.

Use the WELD/NO WELD function to carry out test cycles without welding current. Welding current is enabled or disabled by means of the button shown above. When the lamp is on, the control unit is set to WELD and carries out the standard welding cycles. When the lamp is off, the control unit is set to NO WELD: complete test cycles will be carried out, without welding, while maintaining all the time parameters.

1.3 – PANEL LEDs

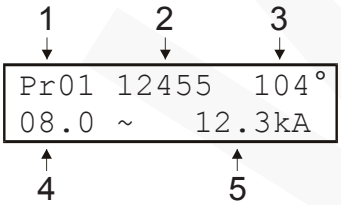
START INIZIO CICLO	If on, this LED indicates that the cycle start command from the button of handle 1 (connected to XS10) is activated.
START 2 INIZIO CICLO 2	If on, this LED indicates that the cycle start command from the button of handle 2 (connected to XS11) is activated.
AUX AUSILIARIO	When this warning light turns on, it means that the stop command by means of pressure only, through the AUX input, is activated. As a rule, it is activated by the "PRESSURE ONLY" selector.
CURRENT CORRENTE	If on, this LED indicates that the control unit is generating the SCR trigger impulses.
SOLENOID VALVE 1 ELETTROVALVOLA 1	It indicates that the solenoid valve executing the main cycle is activated.
SOLENOID VALVE 2 ELETTROVALVOLA 2	It indicates that the solenoid valve driving the double stroke is activated.

1.4 – DESCRIPTION OF THE DISPLAYED INFORMATION

The main screen shows a range of information after each run cycle, both for the cycles run in weld mode, with the control unit set to WELD mode, and for the cycles run in NO WELD mode.

The values displayed in the following description are for reference only.

This is what is displayed by the screen of the TE470 control unit:



1. Pr01

It indicates the program used for the last weld sequence; it may be a number between 01 and 63. It is displayed both in WELD and in NO WELD mode.

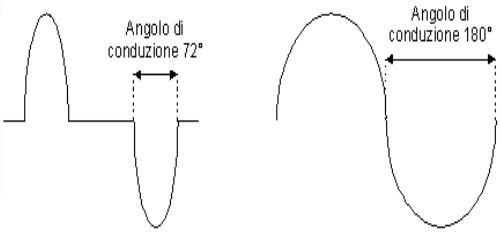
2. 12455

This is the run welds counter; the number ranges from 00000 to 65000. It updates only in WELD mode and resets through keys ▲ and +.

3. 104°

It indicates the current conduction angle of the last weld. In WELD mode, it may have a value between 000° and 180°. In NO WELD mode, the displayed value is 000°. The conduction angle represents the current flowing time along the half-cycle. The displayed value represents the average of the measured values for each half-cycle of the welding time.
The showed value always refers to the main adjustment, basically to the WELD parameter one. In no instance is the conduction angle of the current measured during the slope time. In the case of pulse weldings, the angle value would refer to the last pulse.

Examples of currents having different conduction angles:



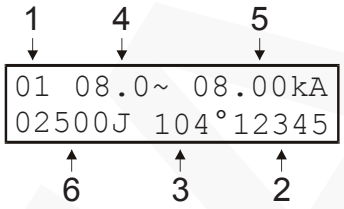
4. 08.0 ~

Indicates the welding time of the last weld. In WELD mode the value is between 00.5 and 99.5. In NO WELD mode the displayed value is 00.0.

5. 12.3 kA

Indicates the value of the current with which the last weld was performed. In WELD mode the value ranges from 00.0 kA to 36.0 kA. In NO WELD mode the value is 00.00kA.
It represents the average of the RMS values measured for every weld time half-period. The displayed value always refers to the main adjustment i.e. to that of the WELD parameter. In the case of impulse welds, the current value will always be the average value of all the impulses.

This is what the screen of the TE480 control unit (Constant Energy) displays:



Where, to the above described information, is added:

6. 02500J

Indicates the value of the total energy with which the last weld was performed. In WELD mode the value ranges from 00000 J to 99999 J. In NO WELD mode the displayed value is 00000 J.

1.5 – CONTROL UNIT SWITCH-ON

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

```
SUPPLY FREQUENCY
     50  Hz
```

```
TE470  REV. 2.21
  WELD CONTROL
```

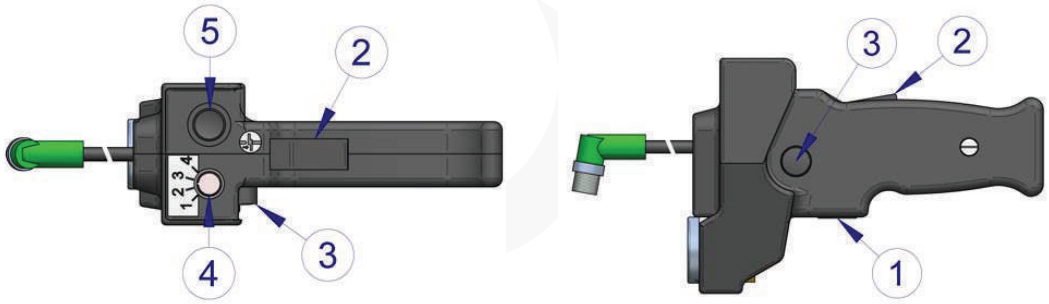
After a few seconds, the TE470/TE480 is set in a waiting condition to carry out the welding process.

```
Pr01 12455  104°
08.0 ~ 12.35 kA
```

Before starting the programming phase, it is important to learn some fundamental features of the control unit.

The TE470/TE480 stores 63 different welding programs. If allowed by the type of handle connected to the control unit, when working it is possible to quickly select up to four different programs called "ADJUSTMENT 1", "ADJUSTMENT 2", "ADJUSTMENT 3" and "ADJUSTMENT 4", respectively. While working, the adjustments are selected by means of a switch or a commutator on the handle.

For example, the choice is made through selector 4 using the following handle.



During the programming stage the user selects, for each adjustment, the weld program to be used.

The control unit dialogs with the user through a LCD. The user programs which language the control unit should display the alarm and error messages.
The control unit is programmed by adjusting the parameters that describe the welding cycle. This is done by selecting the parameters and setting the required values one at a time.
To better understand the meaning of each parameter, refer to the relevant paragraph (PARAMETERS DESCRIPTION).

CHAPTER 2 - CONTROL UNIT PROGRAMMING

2.1 – WELDING CYCLE PARAMETERS PROGRAMMING MENU

Press buttons ▲ and ▼ simultaneously for at least one second to program the welding cycle parameters.

Once inside the menu, the control unit automatically exits from the programming procedure after 8 seconds of inactivity and allows the process to be run.

The first choice to make is the number of the programme. Use buttons + and − to change this value.

```
ADJUSTMENT   1
PROGRAM N.  01
```

After having chosen the number of the programme, select the parameters that make up the program through buttons ▲ and ▼ and set the required value each time, using buttons + and −.
The parameters are identified by a letter (from A to C) or a number (from 1 to 22).

The display shows the following data:

```
1      2      3
ADJ1 PRG01 PRM07
WELD 1   08.0 ~
4          5
```

1. ADJ1

Indicates the ADJUSTMENT associated with the programme. According to the PRG program number selected beforehand, the ADJ will assume the value associated inside the SETUP menu.
It can have the following values:
ADJ1 (ADJUSTMENT 1), ADJ2 (ADJUSTMENT 2), ADJ3 (ADJUSTMENT 3), ADJ4 (ADJUSTMENT 4) or ADJ– when the selected program number is not associated with an ADJ (also see description inside the SETUP menu).

2. PRG01

Indicates the selected program number (e.g.: PRG01 = program number 1) and its value is between 01 and 63.

3. PRM07

Identifies the selected parameter (e.g.: PRM07 = parameter number 7) with a value that includes a letter (from A to C) or a number (from 1 to 22).

4. WELD 1

Indicates the name of the selected parameter (e.g.: WELD 1).

5. 08.0 ~

Indicates the value of the selected parameter (e.g.: 08.0 cycles).

Change the value of the parameters using buttons + and − to increase and decrease the displayed value.

Then set the next parameters using buttons ▲ and ▼.

In this manner the required parameters are set to the value needed to carry out the weld. Keep in mind that no key is to be pressed to confirm the set datum that is stored automatically after the adjustment.

When the programming operations are accomplished, wait until the control unit ends the programming phase; this takes place automatically after 8 seconds of inactivity.

If the start of cycle device is activated before the control unit moves from the programming phase to the working phase, it will not be considered. Release the control device and start it again.

As soon as the welding cycle is activated, the control unit checks the data of the selected program. An error message will be displayed if the values of the parameters are not compatible.

Below the three working modes are described and the three programming screens are shown according to the parameter selected in the WORKING MODE.
The screens contain all the programmable parameters.

2.2 – PERCENTAGE ADJUSTMENT OPERATING MODE

The welding percentage value can be set in the percentage adjustment working mode (WORKING MODE parameter selected in PW%). In this mode, the control unit measures the real effective value (RMS) of the weld current and shows the current value at the end of the weld.
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.

TABLE PERCENTAGE OPERATING MODE PARAMETERS

```
ADJ1 PRG01 PRM A
WORKING MODE  PW%
```

NUMBER	PARAMETER	DESCRIPTION	VALUE RANGE
TO	WORKING MODE	Working mode	PW%
B	CONTROL MODE *	Control unit mode	NO - CURR - DEG
C	STROKE	Double stroke mode	SHORT - LONG - AUTOMATIC
1	SQUEEZE 1	1st squeeze time	00 - 99 cycles
2	SQUEEZE	Squeeze time	01 - 99 cycles
3	PRE-WELD	Pre-weld time	00.0 - 99.0 cycles
4	POWER 1	Pre-weld current	05 - 99 %
5	COLD 1	Cold 1 time	00 - 50 cycles
6	SLOPE UP	Slope up time	00 - 25 cycles
7	WELD	Weld time	00.5 - 99.5 cycles
8	POWER	Weld power	05 - 99 %
9	IMPULSE N.	Number of impulses	01 - 09
10	COLD 2	Cold 2 time	00 - 50 cycles
11	SLOPE DOWN	Slope down time	00 - 25 cycles
12	COLD 3	Cold 3 time	00 - 50 cycles
13	POST-WELD	Post-weld time	00.0 - 99.0 cycles
14	POWER 2	Post-weld current	05 - 99 %
15	HOLD TIME	Hold time	01 - 99 cycles
16	OFF TIME	Interval time	00 - 99 cycles

B	CONTROL MODE *	Control unit mode	NO
17	PRESSURE	Pressure value	0.5 - 10.0 bar

B	CONTROL MODE *	Control unit mode	CURR
17	CURR MIN	Current min limit	1.0 - 36.0 kA
18	CURR MAX	Current max limit	1.0 - 36.0 kA
19	PRESSURE	Pressure value	0.5 - 10.0 bar

B	CONTROL MODE *	Control unit mode	DEG
17	ANGLE MIN	Min limit in degrees	005 - 180°
18	ANGLE MAX	Max limit in degrees	005 - 180°
19	PRESSURE	Pressure value	0.5 - 10.0 bar

There are some peculiar conditions:

- If the OFF TIME (16) is set to zero, the control unit works in single cycle.
- By setting the PRE-WELD parameter (3) to zero, the pre-weld is not carried out.
- By setting the POST-WELD parameter (13) to zero, the post-weld is not carried out.

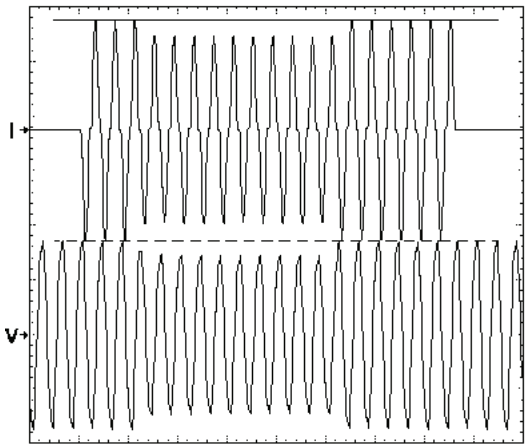
We recommend activating the CONTROL MODE in CUR and checking the use limit conditions before starting the production: if use is with 2 sheets for example, limit conditions are with 1 or 3 sheets. The weld current is adjusted by control unit TE470/TE480.
However, it is necessary to check the welding current 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 undoubtlessly 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 CURRENT OPERATING MODE

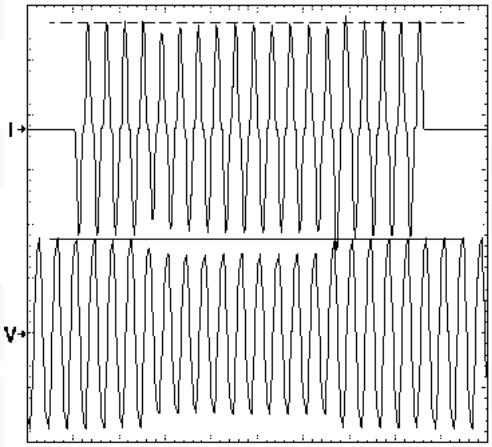
When the weld control unit works in constant current operating mode (parameter WORKING MODE selected in IK), the current value with which to perform the weld is set directly. During the weld, the control unit measures the weld current's real effective value (RMS) in every half-period and maintains the set current according to a mathematical correction algorithm.

In addition to simplifying the programming operations, this operating mode also permits to keep the desired welding current even if some factors change such as: mains voltage, welding circuit dimensions and impedance, conditions of the welding tools or surface condition of the materials being processed.

CONSTANT CURRENT OPERATING MODE SURVEY



Welding current (I) variation according to the mains voltage (V) variation in standard working mode 80%



Welding current (I) variation according to the mains voltage (V) variation in constant current 80% mode

TABLE CONSTANT CURRENT OPERATING MODE PARAMETERS

```
ADJ1 PRG01 PRM A
WORK MODE IK
```

NUMBER	PARAMETER	DESCRIPTION	VALUE RANGE
TO	WORKING MODE	Working mode	IK
B	CONTROL MODE *	Control unit mode	NO - CURR - DEG
C	STROKE	Double stroke mode	SHORT - LONG - AUTOMATIC
1	SQUEEZE 1	1st squeeze time	00 - 99 cycles
2	SQUEEZE	Squeeze time	01 - 99 cycles
3	PRE-WELD	Pre-weld time	00.0 - 99.0 cycles
4	POWER 1	Pre-weld current	05 - 99 %
5	COLD 1	Cold 1 time	00 - 50 cycles
6	SLOPE UP	Slope up time	00 - 25 cycles
7	WELD	Weld time	00.5 - 99.5 cycles
8	CURRENT	Welding current	02.0 – 30.0KA
9	IMPULSE N.	Number of impulses	01 - 09
10	COLD 2	Cold 2 time	00 - 50 cycles
11	SLOPE DOWN	Slope down time	00 - 25 cycles
12	COLD 3	Cold 3 time	00 - 50 cycles
13	POST-WELD	Post-weld time	00.0 - 99.0 cycles
14	POWER 2	Post-weld current	05 - 99 %
15	HOLD TIME	Hold time	01 - 99 cycles
16	OFF TIME	Interval time	00 - 99 cycles

B	CONTROL MODE *	Control unit mode	NO
17	PRESSURE	Pressure value	0.5-10.0 bar

B	CONTROL MODE *	Control unit mode	CURR
17	CURR MIN	Min current limit	1.0 - 36.0 kA
18	CURR MAX	Max current limit	1.0 - 36.0 kA
19	PRESSURE	Pressure value	0.5 - 10.0 bar

B	CONTROL MODE*	Control unit mode	DEG
17	ANGLE MIN	Min limit in degrees	005 - 180°
18	ANGLE MAX	Max limit in degrees	005 - 180°
19	PRESSURE	Pressure value	0.5 - 10.0 bar

We recommend activating the CONTROL MODE in DEG and checking the use limit conditions before starting production: if use is with 2 sheets for example, limit conditions are with 1 or 3 sheets. The control unit adjusts the constant weld current (if the conduction degrees are not near 180°). However, the conduction degrees should be checked with 1 sheet to set the minimum limit and check the value with 3 sheets to set the maximum limit.
However, it is not possible to undoubtlessly 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 - CONSTANT ENERGY WORKING MODE (ONLY IN TE480)

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

```
01 08.0~ 08.00kA
02500J 104°12345
```

Adjustments are performed in the constant energy control unit (TE480) as in a conventional control unit except for the ENERGY parameter and the weld time parameter for which a precise value is not set, just the minimum and maximum value.

During welding, the control unit reads the true efficacious welding current RMS, the non-inductive component of the voltage at the electrodes in volts (V x cos φ) and the welding duration in cycles. The product of I x V x cos φ 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 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

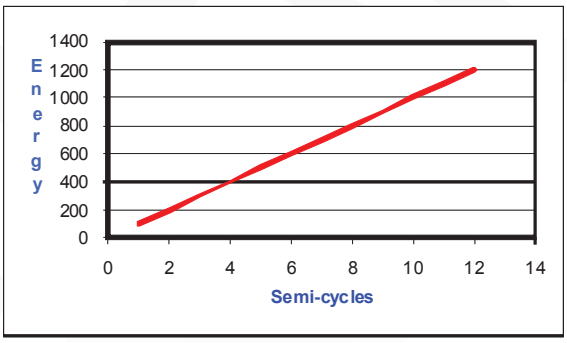


TABLE CONSTANT ENERGY OPERATING MODE PARAMETERS

```
ADJ1 PRG01 PRM A
WORKING MODE ENE
```

NUMBER	PARAMETER	DESCRIPTION	VALUE RANGE
TO	WORKING MODE	Working mode	ENE
B	CONTROL MODE *	Control unit mode	NO - CURR - DEG
C	STROKE	Double stroke mode	SHORT - LONG -AUTOMATIC
1	SQUEEZE 1	1st squeeze time	00 - 99 cycles
2	SQUEEZE	Squeeze time	01 - 99 cycles
6	SLOPE UP	Slop up time	00 - 25 cycles
20	WELD MIN	Weld time	00.5 - 99.5 cycles
21	WELD MAX	Weld time	00.5 - 99.5 cycles
8	POWER	Weld power	05 - 99 %
22	ENERGY	Energy value	00060 - 60000 joule
12	COLD 3	Cold 3 time	00 - 50 cycles
13	POST-WELD	Post-weld time	00.0 - 99.0 cycles
14	POWER 2	Post-weld current	05 - 99 %
15	HOLD TIME	Hold time	01 - 99 cycles
16	OFF TIME	Interval time	00 - 99 cycles

B	CONTROL MODE *	Control unit mode	NO
17	PRESSURE	Pressure value	0.5-10.0 bar

B	CONTROL MODE *	Control unit mode	CURR
17	CURR MIN	Min current limit	1.0 - 36.0 kA
18	CURR MAX	Max current limit	1.0 - 36.0 kA
19	PRESSURE	Pressure value	0.5 - 10.0 bar

B	CONTROL MODE*	Control unit mode	DEG
17	ANGLE MIN	Min limit in degrees	005 - 180°
18	ANGLE MAX	Max limit in degrees	005 - 180°
19	PRESSURE	Pressure value	0.5 - 10.0 bar

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 CORR MAX, the limits are disabled.
By setting the same value for both ANGLE MIN and ANGLE MAX, the limits are disabled.

We recommend activating the CONTROL MODE in CUR and checking the use limit conditions before starting production: if use is with 2 sheets for example, limit conditions are with 1 or 3 sheets. The 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 undoubtlessly assure that the piece has been effectively welded, as all the conditions and parameters involved in the welding process execution should be checked.

2.5 – DESCRIPTION OF THE PARAMETERS

All of the following parameters indicate times that are expressed in periods, also called mains cycles.
The mains frequency determines the duration of 1 period:

Mains frequency 50 Hz 1 period = 20 ms

Mains frequency 60 Hz 1 period = 16.6 ms

PRM A – WORKING MODE

The WORKING MODE parameter defines the program's weld current adjustment mode: either in power percentage (**PW%**), constant current (**IK**) or constant energy (**ENE**). This parameter only affects the weld time (WELD) that will be carried out in the adjustment mode defined in this parameter. The PRE-WELD and POST-WELD times are always executed in power percentage adjustment mode.

PRM B – CONTROL MODE

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

NO There is no control on the supplied welding current.

CUR The TE470/TE480 enables to set the welding current min. and max. limits.

DEG The TE470/TE480 enables to set the min. and max. limits of the welding current conduction angle.

For further information, please read the relevant paragraph.

PRM C – STROKE

Welders with the double stroke function (or approach stroke) can work in the following modes:

SHORT Short stroke

LONG Long stroke

AUTOMATIC Automatically set stroke

Additional data on this function are given in the relevant paragraph.

This parameter can be set only if both the machine and the handle are designed for the control of the double stroke from the control unit.

PRM01 – SQUEEZE 1

The SQUEEZE 1 time (first squeeze) is used during the double automatic stroke work mode (STROKE parameter set to AUTOMATIC). It determines the electrode's shifting time from the long stroke position to the short one.
The set value must be long enough to enable the mobile electrode to reach the short stroke position.
During the first squeeze time, it is possible to end the cycle if the start of cycle signal is deactivated.
This parameter can be programmed and will be displayed only if the machine and the handle contemplate the control unit double stroke management feature.

PRM02 – SQUEEZE

The SQUEEZE time determines the closing time of the electrodes, i.e. the time interval from the moment the electrodes begin to close to the beginning of the weld. The set value must be long enough to allow the electrodes to reach the work piece to be welded and the correct clamping force before the welding operation begins.
A too low adjustment of this time causes sparkles between electrodes and sheet when the welding process starts; it can also cause an unsteadiness of the welding quality.
If the start cycle signal is deactivated during the squeeze time, the sequence is broken up.

PRM03 – PRE-WELD

The PRE-WELD parameter describes the duration of a current flow that can be carried out before the weld, to pre-heat the workpiece.
If the parameter is set to 0, the pre-weld will not be performed. The pre-weld will be performed with a current adjustment equivalent to that indicated in the POWER 1 parameter (pre-weld current).

PRM04 – POWER 1

The value expressed in the POWER 1 parameter indicates the power used to carry out the pre-weld.

PRM05 – COLD 1

The COLD 1 time parameter indicates the time that elapses between the PRE-WELD and the WELD.
When the pre-weld is off (PRE-WELD time equal to 0) this cold time is not carried out.

PRM06 – SLOPE UP

The SLOPE UP parameter describes the time during which the programmed weld current is reached. The initial value of this slope is always equal to the minimum current whilst the final value is equal to the current value programmed in the POWER parameter. The microprocessor calculates this slope automatically, according to the programmed values. The SLOPE UP time is added to the WELD time.

PRM07 – WELD

The WELD time parameter represents the duration of the weld current flow. The weld will be carried out at a power value equal to the one indicated in the POWER parameter. When the impulse mode is activated, this parameter indicates the duration of every single impulse.
This parameter is expressed by three digits since it can be adjusted with the precision of a half period.

PRM08 – POWER / CURRENT

Depending on the adjustment mode selected via the WORKING MODE parameter, the PRM08 parameter can assume the POWER or CURRENT values.

When the WORKING MODE parameter is adjusted to PW% (Power) or ENE (Constant Energy), the POWER parameter appears. Its value indicates the power percentage adjustment with which the weld is carried out.

When the WORKING MODE parameter is adjusted IK (Constant Current), the CURRENT parameter appears. Its value indicates the current adjustment with which the weld is carried out.

PRM09 – IMPULSE N.

The IMPULSE N. parameter indicates the number of impulses used to carry out the welding process. The duration of each impulse is that set in the WELD parameter.

PRM10 – 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.

PRM11 – SLOPE DOWN

The SLOPE DOWN parameter is a weld time that is reached at the end of the welding operation and during which the welding current decreases to minimum by the amount set in POWER or in CURRENT. The microprocessor calculates this slope automatically, according to the programmed values.
The SLOPE DOWN time is always added to the WELD time.

PRM12 – COLD 3

The COLD 3 parameter indicates the time that elapses from the WELD time to the POST-WELD time.

PRM13 – POST-WELD

The POST-WELD time parameter describes the duration of a current flow that can be carried out after the weld time. If the parameter is set to 0, the post-weld will not be carried out. It will be carried out with a current adjustment equal to that indicated in the POWER 2 parameter.

PRM14 – POWER 2

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

PRM15 – 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.

PRM16 – 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 machine works in single cycle, the control unit carries out only one welding cycle each time it receives a cycle start signal.
When the machine works in automatic cycle, the welder continuously carries out welding cycles until the cycle start signal ceases.

PRM17 – PRESSURE / CURR. MIN / ANGLE MIN

The meaning of this parameter depends on the control mode selected in the CONTROL MODE parameter.

In current control mode (CONTROL MODE = CUR), the CURR. MIN parameter fixes a minimum current limit value. For each weld performed, the TE470/TE480 checks that the current supplied by the welder is greater than the value set in this parameter. Otherwise an error occurs (see specific paragraph).

In degrees control mode (CONTROL MODE = DEG), the ANGLE MIN parameter fixes a minimum conduction angle limit value. For each weld performed, the TE470/TE480 checks that the max conduction angle of the supplied welding current is greater than the value set in this parameter. Otherwise an error occurs (see specific paragraph).

The meaning of PRM17 turns into PRESSURE (see next description of PRM19) when instead the CONTROL MODE is set to NO (welding current control OFF) and the PR. VALVE parameter (present in the SETUP MENU) is set to ON (proportional valve ON).

If the CONTROL MODE parameter is set to NO and the PR. VALVE parameter is set to OFF (proportional valve OFF), the PRM17 parameter is not displayed during the programming.

PRM18 – CURR. MAX / ANGLE MAX

The meaning of this parameter depends on the control mode selected in parameter CONTROL MODE.

When the control unit is set to current control mode (CONTROL MODE=CUR), the CURR. MAX parameter fixes a maximum current limit value. For each weld, the TE470/TE480 checks that the current supplied by the welder is lower than the value set in this parameter. Otherwise an error occurs (see specific paragraph).

When the control unit is set to degree control mode (CONTROL MODE=DEG), the ANGLE MAX parameter fixes a maximum conduction angle limit value. For each weld, the TE470/TE480 checks that the maximum conduction angle of the supplied welding current is lower than the value set in this parameter. Otherwise an error occurs (see specific paragraph).

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

PRM19 – PRESSURE

This parameter, expressed in bars, expresses the welding pressure and is used only when the proportional valve is present in the pneumatic system. The set value should guarantee a suitable tightening torque during the weld since an insufficient adjustment of this value produces sparks between electrodes and sheet when the welding begins. This parameter may be activated through the PR. VALVE function in the SETUP MENU.

PRM20 – WELD MIN (only in TE480)

The minimum weld time parameter (WELD MIN) is expressed in periods and represents the minimum welding duration time, which will be carried out with a power value equal to that indicated in the POWER parameter. If an energy value higher than or equal to the corresponding programmed value is measured at the end of said time, the welding will stop. This parameter is displayed only on selecting the ENE (Constant Energy) WORKING MODE.

PRM21 – WELD MAX (only in TE480)

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 WORK MODE is selected in ENE (Constant Energy operating mode).

PRM22 – ENERGY (only in TE480)

This parameter indicates the energy value, expressed in joule, which must be developed during welding. This value must be reached within a number of cycles included between the minimum time (WELD MIN) and the maximum time (WELD MAX).
This parameter is only displayed when the WORK MODE is selected in ENE (Constant Energy operating mode).

2.6 - SETUP MENU

This menu contains the parameters of certain special and configuration functions of the machine on which the control unit works.

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

In order to access this menu, press buttons [+] and [−] at the same time for about one second. Once inside the menu, the different parameters are shown in sequence.

```
TOTAL STEPS   1
SPOTS 1    00000
```

In order to select the parameters, use buttons [▲] and [▼]; to change, use buttons [+] and [−] to increase and decrease the value displayed.

After 8 seconds of inactivity, the control automatically exits the programming procedure and allows the process to be run.

SETUP MENU PARAMETERS TABLES

PARAMETER	DESCRIPTION	VALUE RANGE
TOTAL STEPS	Number of segments per stepper function	1 - 7
SPOTS 1	Number of spots of the first segment	0 - 10000
INCREMENT 1	Increase percentage of the first segment	0 - 60%
SPOTS 2	Number of spots of the second segment	1 - 5000
INCREMENT 2	Increase percentage of the second segment	1 - 60%
SPOTS 3	Number of spots of the third segment	0 - 5000
INCREMENT 3	Increase percentage of the third segment	1 - 60%
SPOTS 4	Number of spots of the fourth segment	0 - 5000
INCREMENT 4	Increase percentage of the fourth segment	1 - 60%
SPOTS 5	Number of spots of the fifth segment	0 - 5000
INCREMENT 5	Increase percentage of the fifth segment	1 - 60%
SPOTS 6	Number of spots of the sixth segment	0 - 5000
INCREMENT 6	Increase percentage of the sixth segment	1 - 60%
SPOTS 7	Number of spots of the seventh segment	0 - 5000
INCREMENT 7	Increase percentage of the seventh segment	1 - 60%
SPOT DRES.	No. of spots for dressing	0 - 999
FIRST INSERT	First insertion delay	1 - 99%
STOP SPOTS	Number of out-of-limit spots before stopping the unit	0 - 9
LANGUAGE	Language of displayed messages	ITA – ENG – ESP –DEU – FRA – UNG – POR – SWE
SERIAL COM.	Serial communication	485 - OFF
ADDRESS	Network address	01 - 31
PROP. VALVE	Proportional valve	ON – OFF
PRESS. RATIO	Proportional valve bar/volt ratio	0.2 – 2.0
HANDLE	Describes the number or type of handles connected to the TE470/TE480	1 – 2 – 4PRG
N.PRG ADJ 1	Number of program associated with ADJUSTMENT 1	01 – 63
N.PRG ADJ 2	Number of program associated with ADJUSTMENT 2	01 – 63
N.PRG ADJ 3	Number of program associated with ADJUSTMENT 3	01 – 63
N.PRG ADJ 4	Number of program associated with ADJUSTMENT 4	01 – 63

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 that make up the relevant segment. The stepper function is deactivated when this parameter is set to zero.
When TOTAL STEPS = 1 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 increase percentage of the current to be reached at the end of the spots set in parameter SPOTS 1. The stepper function is deactivated when this parameter is set to zero.

SPOTS 2, 3, 4...7

These parameters indicate the number of spots of which the relevant segments are made up.

INCREMENT 2, 3, 4...7

These parameters indicate the current increase percentage to be attained at the end of the spots set in the relevant segments.

SPOTS DRESS.

The SPOTS DRESS. parameter indicates the number of spots required at each electrodes dressing.
The following message appears on reaching the spot number set on the control unit:

```
SPOTS FINISHED
DRESS ELECTRODES
```

that is cleared by pressing a key. Then the control unit, without resetting the spots-counter, resumes the welding cycle until it will have again carried out the spots set in this parameter.

FIRST INSERT

The FIRST INSERT parameter indicates the first insertion delay. This function permits optimizing the balance of machine line absorption.
After having selected this parameter, in order to change it you must first press the WELD/NO WELD button. Then the value can be adjusted from 1 to 99 using buttons [+] and [−]. Since this adjustment is performed by the welder manufacturer, the user need not change this value.
For more information refer to the specific chapter.

STOP SPOTS

The STOP SPOTS parameter permits programming the control unit so that it stops when welds are carried out with current values 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 higher or lower than the limits set in parameters CURR. MIN and CURR. MAX, or ANGLE MIN and ANGLE MAX. Adjust this value using buttons [+] and [−] from 0 to 9. Since the function is disabled when this value is set to zero, the welder will never stop if pre-set limits are exceeded.
For further information, please, check the relevant paragraph.

HANDLE

With this parameter, the user determines the number or type of handles connected on the TE470/TE480.

There are 3 different choices:

1	a handle was connected to connector XS10 with the switch for the external calling of 2 programmes.
2	two handles were connected, one to XS10 and the other to XS11.
4PRG	a handle was connected to connector XS10 with the commutator for the external calling of 4 programmes.

For the description of this function, please refer to the relevant chapter ("HANDLES DESCRIPTION").

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.
The languages that may be selected are: ITALIAN – ENGLISH – SPANISH – GERMAN – FRENCH – HUNGARIAN – PORTUGUESE – SWEDISH.

SERIAL COM.

Choose whether or not to activate the serial communication port and how to use it or whether to connect the control unit to a data supervision network (485) or not use this option (OFF).

ADDRESS

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

PR. 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.

PRESS. RATIO

This parameter permits choosing the bar/volt ratio that is most suitable for the type of proportional solenoid valve you intend using and works only if the PR. VALVE parameter is active.
Further pieces of information are described in the paragraph INTERFACE FOR PROPORTIONAL VALVE.

N.PRG ADJ 1

This parameter permits associating the work program number with selection ADJUSTMENT 1.

N.PRG ADJ 2

This parameter permits associating the work program number with selection ADJUSTMENT 2.

N.PRG ADJ 3

This parameter permits associating the work program number with selection ADJUSTMENT 3.

N.PRG ADJ 4

This parameter permits associating the work program number with selection ADJUSTMENT 4.

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/mm2) 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)

It is possible to use this function in a simplified way i.e. by programming a simple percent increase to be applied to a predetermined number of welding spots, which must be carried out with the same electrodes.
To adjust these parameters, it is necessary to know first the electrodes life. Welding tests are carried out with new electrodes and before their replacement. In both cases, the currents which are necessary to carry out the welding process at the required quality are determined. Calculate the percent variation and set it up in the control unit.

The parameters enabling the stepper function are included in the set-up menu. The relevant paragraph shows how to program these parameters.

In order to use the "simplified" stepper function, always set the parameter INCREM. N. to 1 (because only one segment is programmed).
In the SPOTS 1 parameter, enter the number of welds to be carried out, i.e. the foreseen lifespan of the electrodes.
In the INCREMENT 1 parameter, enter the intended percentage increase.

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:

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

The following parameters are then set in the set-up menu:

PARAMETER	DESCRIPTION OF THE PARAMETERS	**VALUE**
TOTAL STEPS	Number of segments for stepper function	1
SPOTS 1	First segment spots number	2000
INCREMENT 1	First segment increment percent	26%

The welding program must be first adjusted to carry out the first weld and then adjusted to obtain the necessary current with the electrodes' starting diameter: 15 kA. It does not matter if the TE470/TE480 is programmed to be adjusted in percentage or constant current since the stepper function works in both modes.

It is then possible to start the welding process. The welding current increases according to the set stepper function. The following diagram shows the current variations:

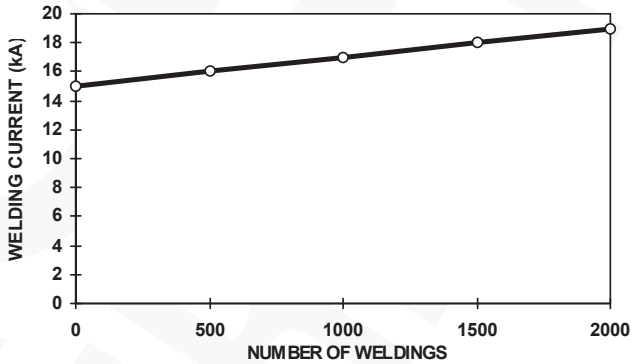
INITIAL CURRENT = 15 kA

FINAL CURRENT = 19 kA

INCREMENT PERCENT = 26 %

WELDING SPOTS NUMBERS = 2000

CURRENT INCREASE DURING THE PRODUCTION



After having performed all the 2000 welds, the TE470/TE480 stops the production and displays the following message:

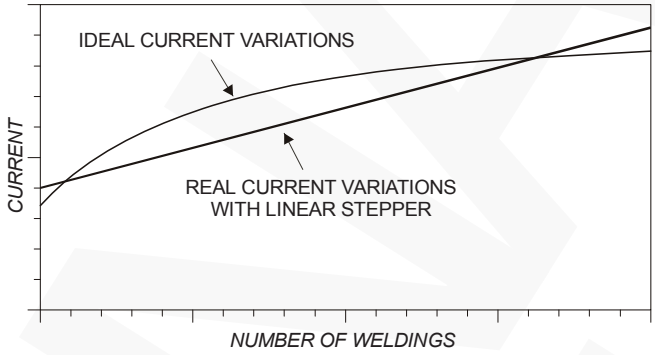
```
MAX SPOTS
NUMBER
```

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

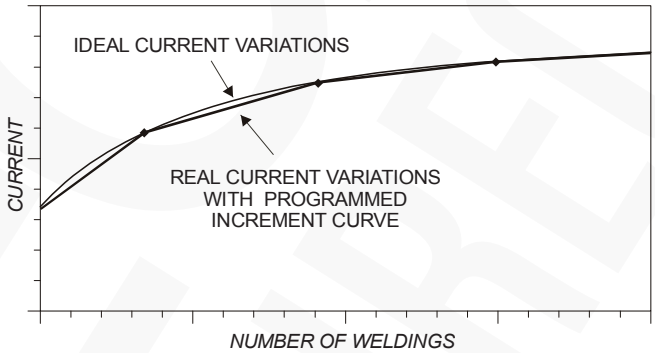
The TE470/TE480 resets the initial work parameters and begins a new increment phase.

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.



The use of the linear increment is an approximation enabling to carry out good results in most applications. Nevertheless, when it is necessary to get the maximum stability of the working condition, it is possible to set a non-linear increment curve by defining a specific number of segments.
This type of adjustment requires a precise knowledge of the electrodes wear out; as well as of the parameters to be used during the electrode life. Therefore, it is necessary to carry out many welding tests in order to determine the working condition in different moments of the electrodes life.



The increment curve is programmed by determining a specific number of linear segments. For each segment it is necessary to determine both the number of the welding spots, and the desired increment.

The INCREM. N. parameter determines the number of segments to be entered in the increment curve. The number of welds that make up the segment are entered in the SPOTS 1,2… parameters; the relevant percentage increment that is to be achieved is entered in the INCREMENT 1,2… parameter.

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 electrodes diameter)	15 kA
700	17.8 kA
1800	19.5 kA
3000	20.2 kA
4000 (end electrodes diameter)	20.7 kA

For each segment, it is then possible to calculate both the duration (expressed in welding spots) and the percent increment.
Please, notice that the percent increment must always be calculated referring to the beginning of the considered segment.

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

$$Change \quad segment\ 1 = \frac{endcurrent - initialcurrent}{initialcurrent}\% \times 100 = \frac{17.8 - 15}{15} \times 100 = 19\%$$

$$Change \quad segment\ 2 = \frac{endcurrent - initialcurrent}{initialcurrent}\% \times 100 = \frac{19.5 - 17.8}{17.8} \times 100 = 10\%$$

$$Change \quad segment\ 3 = \frac{endcurrent - initialcurrent}{initialcurrent}\% \times 100 = \frac{20.2 - 19.5}{19.5} \times 100 = 4\%$$

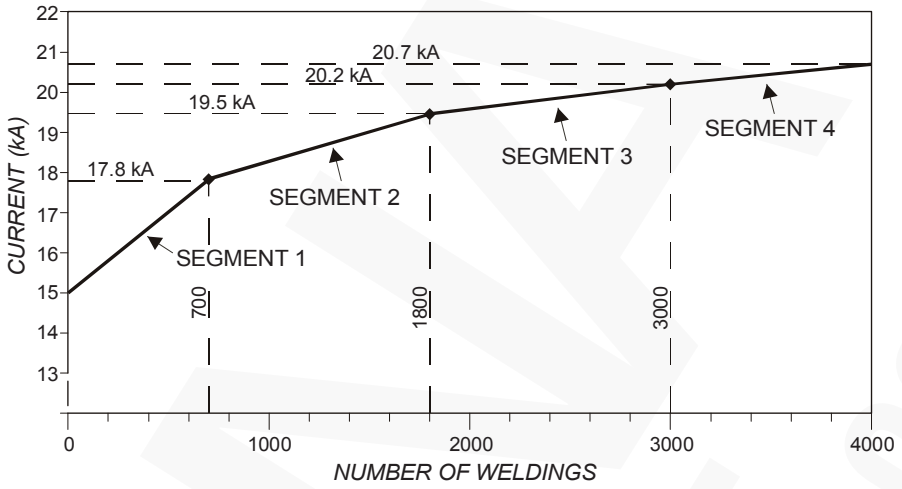
$$Change \quad segment\ 4 = \frac{enecurrent - initialcurrent}{initialcurrent}\% \times 100 = \frac{20.8 - 20.2}{20.2} \times 100 = 3\%$$

The following parameters are set in the **SETUP MENU**:

PARAMETER	PARAMETER DESCRIPTION	VALUE
TOTAL STEPS	Number of segments per stepper function	4
SPOTS 1	Number of spots of the first segment	700
INCREMENT 1	Increment percent of first segment	19%
SPOTS 2	Number of spots of the second segment	1100
INCREMENT 2	Increment percent of second segment	10%
SPOTS 3	Number of spots of the third segment	1200
INCREMENT 3	Increment percent of third segment	4%
SPOTS 4	Number of spots of the fourth segment	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: 15 kA.

It is then possible to start the welding process. The welding current increases according to the set stepper function. The following diagram shows the current variations:



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

```
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 TE470/TE480 resets the initial work parameters and begins a new increment phase.

2.8 – ADJUSTING THE FIRST INSERT DELAY

During the **installation** stage, it is compulsory to adjust the first insert delay to decrease absorption from the feed line and to decrease the power dissipated at the transformer primary circuit (risk of damaging the weld transformer permanently). This adjustment permits optimizing the balance of the machine absorption from mains.

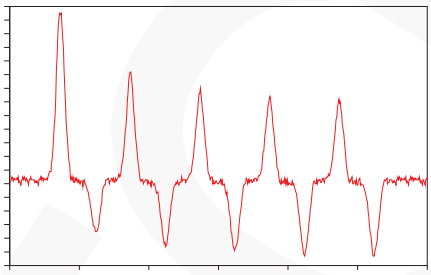
In order to carry out the adjustment, set the control unit to max power value (POWER=99%) and carry out "no load" welds, cutting off the secondary circuit (e.g.: by placing insulation between electrodes).

Adjust parameter FIRST INSERT, in the SETUP MENU, so that positive and negative line absorptions are balanced. Use an ammeter to measure the maximum positive and negative peak values. The adjustment is correct when the positive peak value is similar to the negative one.

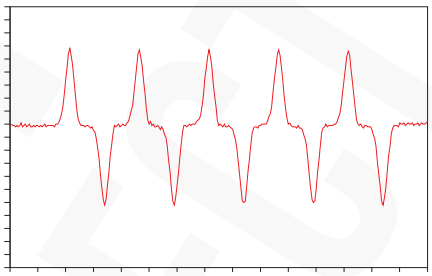
Use an appropriate current gauge having a CAT III 600V class of insulation and work by wearing specific insulated gloves when making interventions at powered lines.

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 charts show waveforms obtained through a wrong and a correct adjustment.



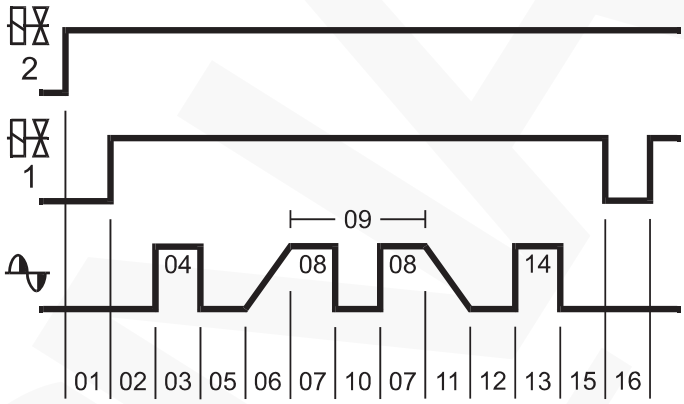
Unbalanced absorption



Balanced absorption

CHAPTER 3 – THE WORK CYCLE

The user defines the work cycle to be carried out by the TE470/TE480 by adjusting the programming parameters. These parameters describe the operating times and the current adjustments that, in sequence, constitute the work cycle.
The graph below shows in which sequence the programmed functions are carried out.



The numbers refer to the programming parameters.

01	SQUEEZE1 (EV2) *	**09**	IMPULSE N. *
02	SQUEEZE (EV1)	**10**	COLD 2 *
03	PRE-WELD *	**11**	SLOPE DOWN
04	POWER 1 *	**12**	COLD 3
05	COLD 1 *	**13**	POST-WELD
06	SLOPE UP	**14**	POWER 2
07	WELD	**15**	HOLD TIME
08	POWER / CURRENT	**16**	OFF TIME

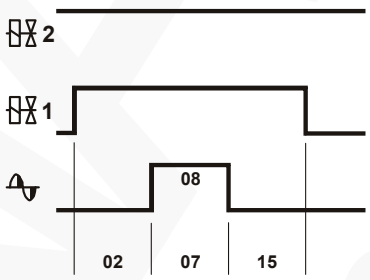
Parameters marked by symbol * can be enabled or disabled according to the programmed WORKING MODE or STROKE.

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

3.1 – EXAMPLES OF WORK PROGRAMS

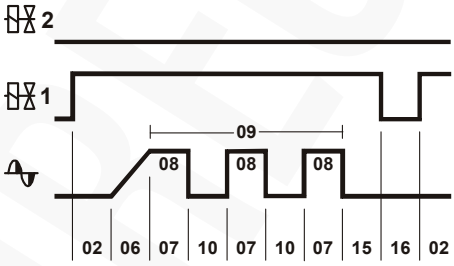
4 TIMES SIMPLE CYCLE, SHORT STROKE, SINGLE CYCLE

NUMBER	PARAMETER	VALUE
TO	**WORKING MODE**	**PW%**
B	**CONTROL MODE**	**NO**
C	**STROKE**	**SHORT**
1	**SQUEEZE 1**	**10 cycles**
2	**SQUEEZE**	**20 cycles**
3	PRE-WELD	00 cycles
4	POWER 1	05 %
5	COLD 1	00 cycles
6	SLOPE UP	00 cycles
7	**WELD**	**16 cycles**
8	**POWER**	**40 %**
9	IMPULSE N.	01
10	COLD 2	00 cycles
11	SLOPE DOWN	00 cycles
12	COLD 3	00 cycles
13	POST-WELD	00 cycles
14	POWER 2	05 %
15	**HOLD TIME**	**09 cycles**
16	OFF TIME	00 cycles



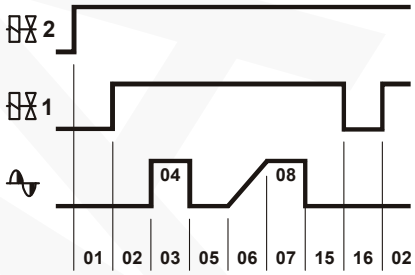
CYCLE WITH PULSES AND SLOPE UP, LONG STROKE, AUTOMATIC CYCLE

NUMBER	PARAMETER	VALUE
TO	**WORKING MODE**	**PW%**
B	**CONTROL MODE**	**NO**
C	**STROKE**	**LONG**
2	**SQUEEZE**	**30 cycles**
3	PRE-WELD	00 cycles
4	POWER 1	05 %
5	COLD 1	00 cycles
6	**SLOPE UP**	**06 cycles**
7	**WELD**	**04 cycles**
8	**POWER**	**40 %**
9	**IMPULSE N.**	**03**
10	**COLD 2**	**03 cycles**
11	SLOPE DOWN	00 cycles
12	COLD 3	00 cycles
13	POST-WELD	00 cycles
14	POWER 2	05 %
15	**HOLD TIME**	**09 cycles**
16	**OFF TIME**	**35 cycles**



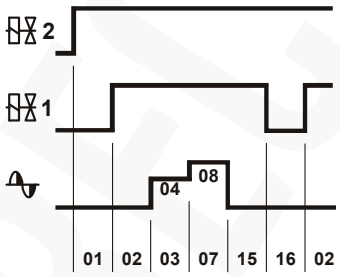
CYCLE WITH PRE-WELD, SLOPE UP, AUTOMATIC STROKE, AUTOMATIC CYCLE

NUMBER	PARAMETER	VALUE
TO	WORKING MODE	PW%
B	CONTROL MODE	NO
C	STROKE	AUTOMATIC
1	SQUEEZE 1	20 cycles
2	SQUEEZE	30 cycles
3	PRE-WELD	08 cycles
4	POWER 1	20 %
5	COLD 1	10 cycles
6	SLOPE UP	04 cycles
7	WELD	12 cycles
8	POWER	60 %
9	IMPULSE N.	01
10	COLD 2	00 cycles
11	SLOPE DOWN	00 cycles
12	COLD 3	00 cycles
13	POST-WELD	00 cycles
14	POWER 2	05 %
15	HOLD TIME	09 cycles
16	OFF TIME	40 cycles



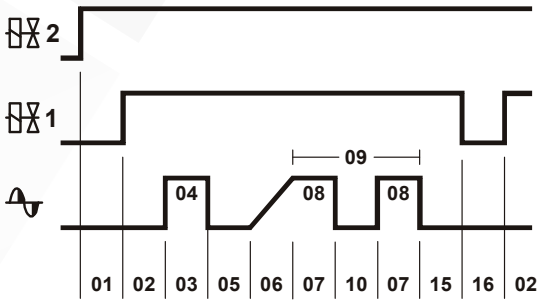
CYCLE WITH PRE-WELD, AUTOMATIC STROKE, AUTOMATIC CYCLE, WITHOUT COLD TIME BETWEEN PRE-WELD AND WELD (COLD 1 TIME =00)

NUMBER	PARAMETER	VALUE
TO	WORKING MODE	PW%
B	CONTROL MODE	NO
C	STROKE	AUTOMATIC
1	SQUEEZE 1	20 cycles
2	SQUEEZE	30 cycles
3	PRE-WELD	08 cycles
4	POWER 1	20 %
5	COLD 1	00 cycles
6	SLOPE UP	00 cycles
7	WELD	12 cycles
8	POWER	60 %
9	IMPULSE N.	01
10	COLD 2	00 cycles
11	SLOPE DOWN	00 cycles
12	COLD 3	00 cycles
13	POST-WELD	00 cycles
14	POWER 2	05 %
15	HOLD TIME	09 cycles
16	OFF TIME	40 cycles



COMPLEX CYCLE WITH PRE-WELD, SLOPE UP, PULSES, AUTOMATIC STROKE, AUTOMATIC CYCLE

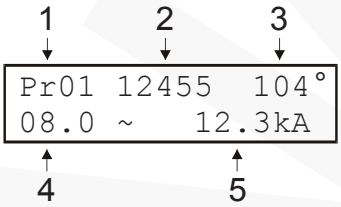
NUMBER	PARAMETER	VALUE
TO	WORKING MODE	PW%
B	CONTROL MODE	NO
C	STROKE	AUTOMATIC
1	SQUEEZE 1	30 cycles
2	SQUEEZE	20 cycles
3	PRE-WELD	08 cycles
4	POWER 1	20 %
5	COLD 1	10 cycles
6	SLOPE UP	04 cycles
7	WELD	12 cycles
8	POWER	60 %
9	IMPULSE N.	02
10	COLD 2	06 cycles
11	SLOPE DOWN	00 cycles
12	COLD 3	00 cycles
13	POST-WELD	00 cycles
14	POWER 2	05 %
15	HOLD TIME	09 cycles
16	OFF TIME	40 cycles



CHAPTER 4 - WELDING CURRENT AND CONDUCTION ANGLE MEASURE

The following data are displayed after each weld:

1) Welding program used.
2) Number of welds carried out after the last counter reset.
3) Last weld current conduction angle.
4) The programmed weld time.
5) Current of the last weld.

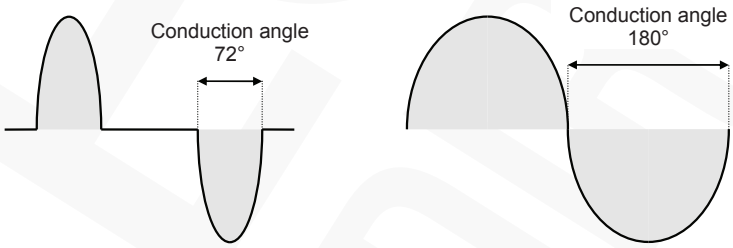


The displayed current value measured by the control unit represents the average of the **RMS** values measured for each weld time half-period. The displayed value always refers to the main adjustment i.e. to that of the WELD parameter. In the case of pulse welds, the value of the current is always that of the last impulse.
The PRE-WELD current, the POST-WELD current and the current that flowed during the slope times are never measured.

The control unit also measures the welding current conduction angle.

The conduction angle represents the current flow time during the half-period. The displayed value represents the average of the values measured for each weld time half-period. The displayed value always refers to the main adjustment, i.e. to that of the WELD parameter. The conduction angle of the PRE-WELD current, the POST-WELD current and the current that flowed during the slope times is never measured. In the case of pulse welds, the value of the angle always refers to the last impulse.
Its highest attainable value is 180 degrees.

Examples of currents having different conduction angles:



If a welding test is carried out in NO WELD, both welding current and conduction angle displayed values are, of course, equal to zero.

CHAPTER 5 - STOP DUE TO SPOTS OUT OF LIMIT

The machine may be stopped when a consecutive series of out-of-limits welds occur. This stop allows the user to keep under control the welding current consistency for the purpose of obtaining constant qualitative results. The number of consecutive welds that stop the control unit is set via the STOP SPOTS parameter in the setup menu (refer to the relevant paragraph for the programming).

```
   SETUP MENU
STOP SPOTS   1
```

This value may vary from 0 to 9. When programmed to 0, the function is disabled and therefore the welder does not stop under any circumstance on exceeding set limits.

It is important to note that in order to count the out-of-limit welds, they must be consecutive. In addition to setting the STOP SPOTS parameter, also enable the CONTROL MODE parameter in one of the control unit's allowed modes.

The TE470/TE480 can work in one of the following control modes.

5.1 - WELDING CURRENT LIMITS

Activate this mode by setting parameter PRM B - CONTROL MODE to CUR.

```
ADJ1 PRG01 PRM B
CONTROL MODE 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.

```
ADJ1 PRG01 PRM17
CURR. MIN  10.5
```

```
ADJ1 PRG01 PRM18
CURR. MAX  12.5
```

When the programmed condition occurs, the control unit stops and an error message is displayed. The displayed message refers to 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:

```
STOP LIMIT
 MIN CURR.
```

```
STOP LIMIT
 MAX CURR.
```

5.2 – CONDUCTION ANGLE LIMITS

Activate this mode by setting parameter PRM B - CONTROL MODE to DEG.

```
ADJ1 PRG01 PRM B
CONTROL MODE  DEG
```

Two new parameters will be displayed:

ANGLE MIN conduction angle lower limit
ANGLE MAX conduction angle upper limit

that permit setting current conduction angle limit values.

```
ADJ1 PRG01 PRM17
ANGLE MIN   080
```

```
ADJ1 PRG01 PRM18
ANGLE MAX   120
```

In conduction angle control mode (CONTROL MODE = DEG), if the current conduction angle value of the last weld is less than or greater than the values set in the foregoing parameters, one of the following messages is displayed:

```
STOP LIMIT
LOW ANGLE
```

```
STOP LIMIT
HIGH ANGLE
```

To reset these errors, simply release the cycle start control button and press a key.

CHAPTER 6 – WELDS COUNTER FUNCTION

A welds counter has been built into the control unit to count the welds carried out, with the possibility of programming the max limit. During the process, the counter's present value is displayed.
The counter increases at each performed weld whilst cycles performed in NO WELD mode are not counted.

In order to reset the counter, press keys [▲] and [+] simultaneously for about 1 second. The following message is displayed:

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

On pressing key [−] the counter resets and after 8 seconds the procedure ends without resetting the counter.

The maximum welds number is set by following the same procedure stated for the stepper function.

For example, if the control unit is set to carry out 2840 welds and then stops, set the following parameters in the setup menu:

PARAMETER	VALUE
TOTAL STEPS	1
SPOTS 1	2840
INCREMENT 1	0%

When the counter reaches the number of welds set in parameter SPOTS 1, the control unit shows the following message:

```
MAX SPOTS
NUMBER
```

and does not permit carrying out other welds until the counter has been reset.

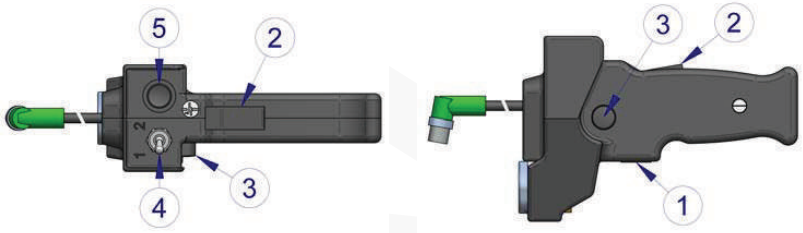
If the SPOTS 1 parameter is set to zero, the stop function is disabled.

CHAPTER 7 - HANDLES DESCRIPTION

Below are briefly described the characteristics of the handles that the TE470/TE480 can manage and be fitted with.

Set the HANDLE parameter inside the SETUP MENU by indicating the number or type of handle that is connected to the control unit.

Handle with 2-position selector without double stroke or with double stroke

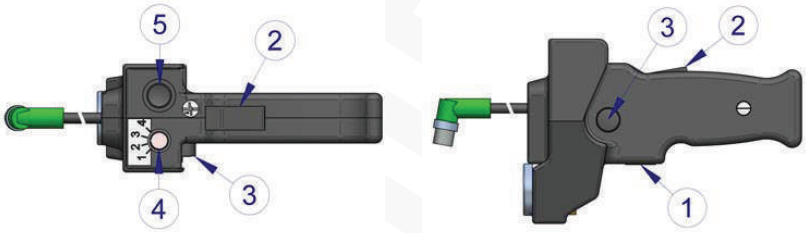


1. Cycle start control button (START input)
2. Safety function button (CHK input)
3. PRESSURE ONLY function control button (AUX input)
4. Switch for calling the second work program ADJUSTMENT 2 (RIC2 input)
5. Button for the "wide opening" function (OPEN input) when the double stroke function is present

Set the HANDLE parameter to 1 when only one handle is connected to input XS10. In this configuration, the programs selected in ADJUSTMENT 1 and 2 will be called.

Set the HANDLE parameter to 2 when 2 handles are connected: one to input XS10 and the other to input XS11. In this configuration, even the programs selected in ADJUSTMENT 3 and 4 will be called through the handle connected to XS11.

Handle with 4-position selector without double stroke or with double stroke



1. Cycle start control button (START input)
2. Safety function button (CHK input)
3. PRESSURE ONLY function control button (AUX input).
4. Commutator for calling four work programs: ADJUSTMENT 1, 2, 3 and 4 (RIC2 and RIC3 inputs)
5. Button for the "large opening" function (OPEN input) when the double stroke function is present

This type of handle can be connected only to the XS10 input of the cover and in this case you must set the HANDLE parameter to 4PRG.

CHAPTER 8 – INPUTS AND OUTPUTS OPERATION

Below are described the functions relative to the input and output signals on the TE470/TE480 control unit.

8.1 – FUNCTION OF THE "PRESSURE ONLY" COMMAND ("AUX" INPUT)

Usually the PRESSURE ONLY command (AUX input) is used to check, before carrying out a weld, that the electrodes are properly positioned.
By activating the PRESSURE ONLY control (usually by pressing a push button placed on the welder handle) while the electrodes are closing, the welder clamps the pieces to weld and waits; the operator, after having checked the correct positioning of the electrodes, enables the cycle to continue by deactivating the control PRESSURE ONLY (releasing the push button). If the electrodes are not correctly positioned, the operator can cancel the operation by releasing the start of cycle device.

For welders with double stroke control only:
When the control unit is programmed to "short stroke" mode (STROKE=SHORT parameter), the PRESSURE ONLY command can be used to move the electrodes from the "long stroke" position to the "short stroke" position, without closing the electrodes on the workpiece. At times this operation is needed during special weld conditions (e.g.: work on narrow thicknesses or high precision work).
The electrodes can be placed in a "long stroke" position either because they have been opened by means of the OPEN control, or because the welder has just been switched on.
When starting the welding cycle, the TE470/TE480 brings the electrodes to "short stroke" position, thus activating solenoid valve EV2 in 0.6 seconds. If the PRESSURE ONLY control is activated, the welding cycle stops in this position. By keeping this condition for one second and then deactivating the cycle start control, the electrodes stay in the "short stroke" position.
If the PRESSURE ONLY control is released, the cycle continues and the welding is accomplished.

8.2 - "SAFETY" CONTROL FUNCTION ("CHK" INPUT)

On the handle of the suspended welding gun a safety microswitch can be installed that carries out a special function: it enables to start the cycle only if the operator has previously grasped the handle. As a rule, this microswitch is placed in series to the start of cycle one.
In order to enhance safety, the control unit checks, through the CHK input, that the safety microswitch energizes when a weld starts. Otherwise the TE470/TE480 does not accept the cycle start signal.

Moreover, the control unit checks that this micro-switch is neither broken (it keeps closed), nor tampered. This test is carried out:

- when switching the control unit on,
- when shifting from PROGRAM to RUN

Under these conditions, the control unit displays the following error message, and it does not enable the welding process.

```
PLEASE, SAFETY
  RELEASE
```

The error does not block the machine functioning; the error will be automatically cleared, when its cause is removed.

8.3 – FUNCTION OF THE THERMOSTAT OR FLOWSWITCH INPUT (OPTIONAL)

This input is connected to a normally closed thermostat, which is placed on the welder. When starting the welding cycle, if the following error message is displayed

```
THERMOSTAT OR
FLOWSWITCH ERROR
```

which indicates that the safety thermostat or the flowswitch (optional) has been triggered. It is not possible to carry out welding processes until the thermostat has been reset.

If this error occurs, check that the cooling water circulates in the required quantity and temperature. Also check the working rate: it must not be too high according to the machine features.

To cancel the message, both the safety device and the cycle start device must be released and then a key must be pressed to cancel the error.

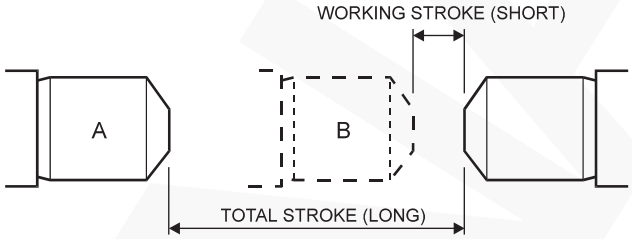
8.4 - CYCLE END OUTPUT

The CYCLE END signal indicates the end of the welding cycle.
This output is an opto-electronic contact that closes at the end of the hold time, the duration of which changes depending on 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

CHAPTER 9 – DOUBLE STROKE FUNCTION

The double stroke function is enabled only when the control unit is connected to the handle that contemplates this function. In machines not fitted with the control unit double stroke management, this function is disabled and the value set in the SQUEEZE 1 parameter will not be carried out.
The EV2 control unit output controls the double stroke solenoid valve. It is always disabled when the machine is turned on even if the control unit has been programmed for the short stroke work mode.
The OPEN input, connected to a button within the operator's reach, is to be used to deactivate the double stroke (electrode opening).



A - MOBILE ELECTRODE POSITION WITH DISCONNECTED DOUBLE STROKE (LONG STROKE)
B - MOBILE ELECTRODE POSITION WITH OPERATING DOUBLE STROKE (SHORT STROKE)

The operator selects one of the three possible work modes through the STROKE parameter (SHORT, LONG, AUTOMATIC), described below.

SHORT

By programming the value of the STROKE parameter to SHORT, the operator adjusts the control unit for the short stroke. In this mode, solenoid valve EV2 remains active and the mobile electrode, in rest condition, will be in position "B".
If during the process the operator needs to open the electrodes, he/she presses the "wide opening" button that deactivates solenoid valve EV2 through the OPEN input.

After having pressed the "wide opening" button, or on turning on the machine, the electrode is in position "A"; the control unit moves it to position "B" when the first weld is carried out.
During this first weld, the TE470/TE480 activates solenoid valve EV2 (that brings the electrode from position "A" to position "B"), waits a fixed time of 0.6 seconds and then carries out the programmed weld cycle. At the end of the welding, solenoid valve EV2 does not deactivate and the electrode remains in position "B". The next welds will be carried out beginning from this position.

The electrodes can be moved from long stroke position to short stroke position through the PRESSURE ONLY command (see paragraph FUNCTION OF THE "PRESSURE ONLY" COMMAND).

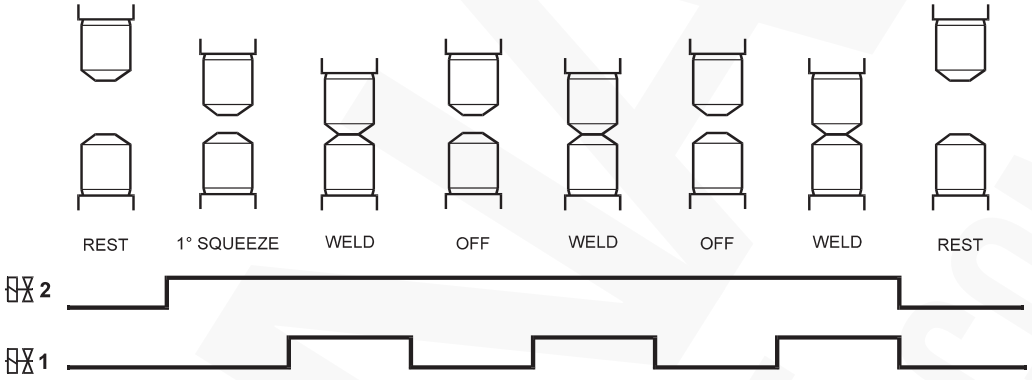
Notice that each time the programming of the control unit starts, the double stroke SV2 is deactivated.

LONG

By programming the value of the STROKE parameter to LONG, the operator adjusts the control unit for the long stroke. In this mode, solenoid valve EV2 remains inactive and the mobile electrode, in rest condition, is in position "A".
In this case the activation of the OPEN input has no effect. No first squeeze time (SQUEEZE1) will be executed during the welding cycle.

AUTOMATIC

By programming the value of the STROKE parameter to AUTOMATIC, the operator adjusts the control unit for the automatic stroke. This mode is used during the automatic cycle mode (PAUSE parameter other than 0). It allows carrying out consecutive welding cycles with the short stroke but starting from a long stroke work condition, useful, for example, for inserting the welding gripper in the workpiece to be welded.



When the welding cycle starts, the control unit activates solenoid valve EV2 (that moves the electrode from position A to position B) and carries out the programmed first squeeze time (SQUEEZE 1) before activating EV1. After having carried out the first weld of the automatic cycle, solenoid valve EV2 is not deactivated and the first squeeze time (SQUEEZE1) is ignored during the subsequent welds. This continues until the operator releases the cycle start control that ends the welds sequence; the control unit deactivates both EV1 and EV2, which moves the electrodes back to the wide opening position. If the double stroke had already been activated before the welding had begun, the control unit does not carry out the first squeeze time.

CHAPTER 10 – OPTIONS

10.1 - RS-485 SERIAL INTERFACE

Should you will need a network connection, please contact TECNA for technical support.

The RS-485 serial expansion card allows the control unit to be networked to other weld control units and to a central personal computer to program the control unit or to document production data. The card interfaces with the control unit through a 6-pin connector and with the external 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 can be connected only when the control unit is not powered-on. It is also advisable to first connect the 6-pin twin wire, which connects the weld control unit, and then the RS485 connection. Then power on the control unit and activate the **NET/485** function in the SETUP MENU.
During the network communication, the weld control unit (slave) requires the assignment of an identification address in order to be recognized by a Master, a Personal Computer for example. Even this parameter, called ADDRESS, is set in the SETUP MENU.
In order to manage data and communication between the networked control units, there is a PC software called **"TECNANet"** designed to check the network structure, i.e. how many and which control units are connected, remotely performing the programming in each control unit and acquiring and saving 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.

10.2 – 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.

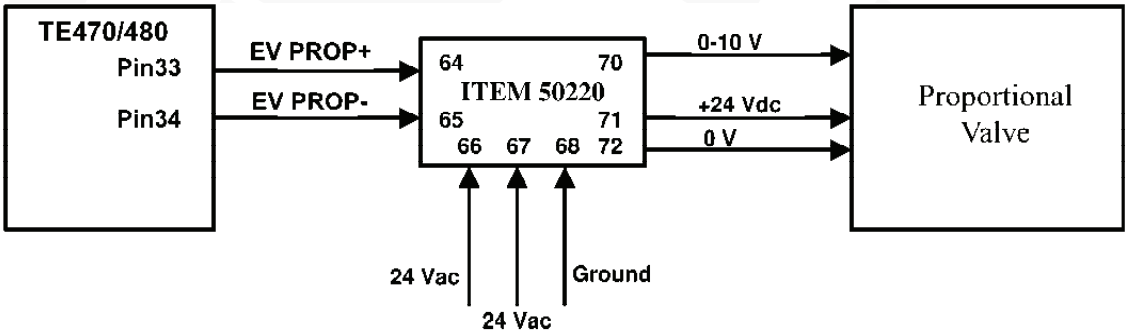
TERMINAL STRIP CONNECTIONS	
64	PROP SV + from the control unit (PIN 33)
65	PROP SV - from the control unit (PIN 34)
66	24Vac
67	24Vac
68	Ground
69	OUT-I
70	0 - 10Vdc at the proportional SV
71	+24Vdc at the proportional SV
72	Ground at the proportional SV

You can program the control voltage range of the proportional valve directly via the weld control unit. The SETUP MENU contains the PRESS. RATIO parameter by means of which to choose the **bar/volt** ratio most suited to the type of solenoid valve you intend using.

Example:

PRESSURE Parameter (bar)	PRESS. RATIO Parameter (bar/volt)	Output (volt)
5.0	1.0	5
5.0	2.0	2.5
5.0	0.5	10

CONNECTIONS DIAGRAM:



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 11 – DESCRIPTION OF THE SIGNALS ON THE TERMINAL STRIP

CONNECTOR XS1 (12 PINS)

NUMBER	NAME	MEANING
5 **7**	VAC VAC	This is the control unit's power supply that must be 24 Vac. The power transformer must be at least 13 VA and should power only the control unit to avoid possible sources of interference.
12	GND	Ground connection. **Pay attention not to invert the VAC wire (5-7) or the fuses of the control unit could be damaged.**
8 **1**	TRG + COM2	Control output for powering on the SCRs. This output is a rectangular wave, amplitude of 30V. Use trigger modules produced by TECNA with opto-isolators.
4 **3**	ROG ROG	Connect the current transducer (or the Rogowski coil to this analog input). The transducer used should have a sensitivity of 150 mV/kA with a load of 1 kΩ.
9 **2**	EV1 COM2	Connect it to the solenoid valve that controls the main cycle. This command is suitable for controlling a 24 Vdc max 3.5 W coil.
11 **10**	FLUX/TERM COM1	This input is for the connection of a NC thermostat. Even a flowswitch can be connected in series with the thermostat.
6 **2**	EV2 COM2	Connection for the solenoid valve that controls the double stroke. This command is suitable for controlling a 24 Vdc max 3.5 W coil.

NOTE: the outputs EV1, EV2, TRG+ are protected against short circuit thanks to electronic devices with automatic restart.

XS2 CONNECTOR (10 PINS) – HANDLE

NUMBER	NAME	MEANING
21 **25**	CHK COM1	Input used to check any safety function on the handle. This input is active when closed towards common COM1. If this function is not used because the handle is not equipped with this microswitch, short-circuit this input with the START one (pin 4). **This disables the safety function against accidental activation.**
22 **25**	RIC2 COM1	This input permits calling weld adjustment number 2 (ADJUSTMENT 2). In order to work efficiently, this input should be enabled before the cycle start signal. This input is activated when it is closed on the common COM1.
23 **25**	AUX COM1	This input allows an external device to stop the welding cycle during the squeeze phase. It is normally used for the "PRESSURE ONLY" function. The contact connected to this input must be of the normally open type.
24 **25**	START COM1	Connect it to the microswitch of the device that starts the weld cycle of the first handle (connected to XS10). This input is activated when closed on the common COM1.
26 **25**	OPEN COM1	Normally connected to the "wide opening" microswitch on the welder handle. It allows opening the double stroke. The input is active when closed on the common COM1. In handles not fitted with this function, the OPEN signal is always short circuited with the common COM1. This indicates to the control unit that it must not carry out the double stroke function. **If the OPEN input is closed on powering-on the TE470, the double stroke function is DEACTIVATED.**
27 **25**	START NC COM1	Connect it to the microswitch of the device that starts the weld cycle of the first handle. This input is activated when it is open. This input is currently inactive.
28 **25**	RIC3 COM1	This input permits calling weld adjustment number 3 or 4 (ADJUSTMENT 3 or ADJUSTMENT 4). In order to work efficiently, this input should be enabled before the cycle start signal. This input is activated when it is closed towards the common COM1.

29 **25**	START2 COM1	Connect it to the microswitch of the device that starts the weld cycle of the second handle (connected to XS11). This input is activated when closed on the common COM1.
30 **25**	START2 NC COM1	Connect it to the microswitch of the device that starts the weld cycle of the second handle. This input is activated when it is open. This input is currently inactive.

CONNECTOR XS3 (6 PINS)

NUMBER	NAME	MEANING
36 **35**	END - END +	This output is a polarised optic-electronic switch max 30Vdc/10mA, and is used to signal the completion of a cycle.
34 **33**	PROP SV - PROP SV +	This is an output for the connection to the control card of the proportional valve.
32 **31**	VE VE	The electrodes' voltage signal should be connected to this analog input through the appropriate isolation transformer.

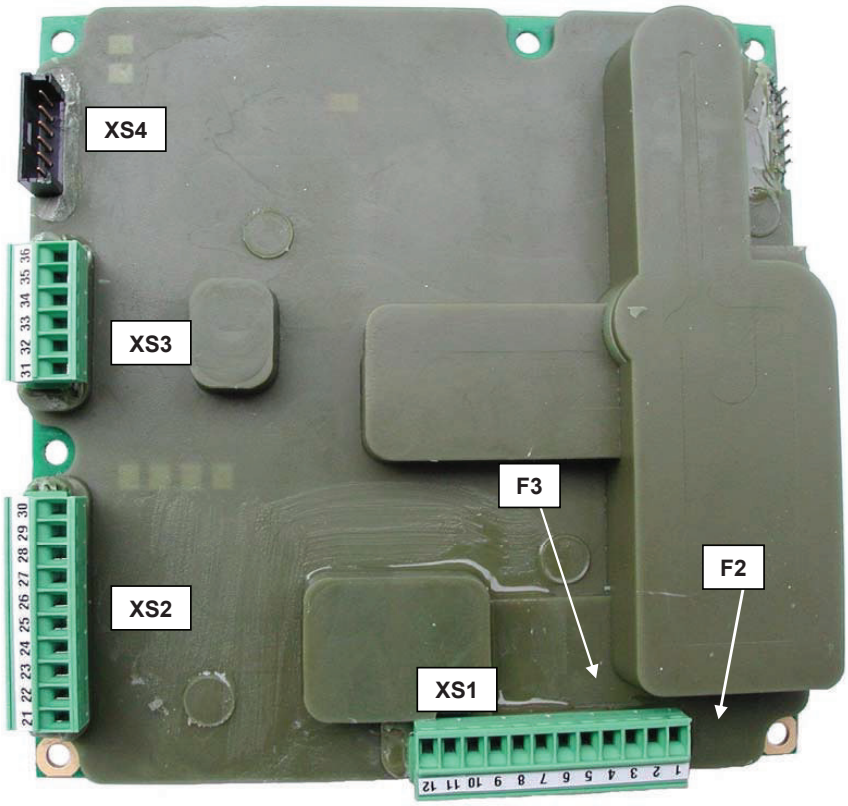
ORDINARY AND EXTRAORDINARY MAINTENANCE

Frequently check the correct functioning and the status of both control devices and relevant connecting cables. Do not wash the control unit with water which could enter it; avoid strong solvent, thinner and gases which could damage the plastic components of the control unit.

The built-in ammeter is calibration-free. In any case, its working efficiency should be checked by comparing the measurement of the TE470/TE480 with that of another instrument. The built-in ammeter measures the current's real effective value (RMS) (see chapter "WELDING CURRENT AND CONDUCTION ANGLE MEASURE"). The instrument used for comparison should be able to perform the same type of measurement.

NOTES:

If the control unit does not turn on, check that the 24Vac power supply is present at Pins 5-7 of connector XS1). If power supply is present, check the state of the control unit fuses. The components marked "F2" and "F3", located on the connectors side, are delayed fuses that cannot be restored and that can withstand a max current of 4 A each ("LITTELFUSE" 460004).



CHAPTER 12 – LIST OF MESSAGES

MESSAGE	PROBABLE CAUSES	POSSIBLE SOLUTIONS
SUPPLY FREQUENCY 50 Hz	The control unit measured a mains frequency of 50 Hz.	
SUPPLY FREQUENCY 60 HZ	The control unit measured a mains frequency of 60 Hz.	
FAULT/MISSING MAINS SYNCHRONISM	A "synchronism" error occurred due to the temporary omission of the power line reference signal or to the presence of line interference.	Power off the control unit and check the working efficiency of the devices that cut the supply line and check if there is any interference.
PRESS BUTTON [+] TO RESET DATA	The control unit data reset procedure was activated.	To continue, press button [+] otherwise press any other key and wait a few seconds.
MEMORY RESET	The control unit is entering default values into its programs memory.	
TE470 REV. 2.21 WELD CONTROL	When powered-on, the control unit display shows the type of control unit and software version.	
SOLENOID VALVE SHORT CIRCUITED	One of the solenoid valve outputs is short circuited.	Check the electrical connections of the control unit. Check the solenoid valve coils.
THERMOSTAT OR FLOWSWITCH ERROR	The safety thermostat or flowswitch inside the welder tripped.	Check that the water flows in the welder in the required quantity and/or check the working efficiency of the thermostat.
RELEASE SAFETY	The CHK signal indicates that the safety on the handle is activated when it should not be. This may be due to a malfunction or tampering.	Check.
MODIFICATION CODE 0 0 0	Enter the code to be able to access the programming or setup menus.	
RELEASE OPEN BUTTON	The OPEN signal on the handle is active when the user exits from a programming menu.	Check the handle and the input of the OPEN signal.
MAX SPOTS NUMBER	The weld spots counter has reached the max limit set to replace the electrodes.	Reset the welds counter, see relative chapter.
CLEAR COUNTER SPOTS? [-]=YES	Buttons [▲] and [+] were pressed to reset the number of spots and the control unit requests confirmation.	Press button [−] to reset the spots otherwise wait a few seconds.
NO SIGNAL CURRENT ERROR	During the last welding cycle, which has been carried out in constant current, there was no circulation of secondary current.	Check the continuity and the correct positioning of the current transducer.
STOP LIMIT LOW CURRENT	A certain number of welds were performed outside the set limits. The last weld was performed with a current value lower than the min set limit.	Reset the error by pressing any button.

STOP LIMIT HIGH CURRENT	A certain number of welds were performed outside the set limits. The last weld was performed with a current value higher than the max set limit.	Reset the error by pressing any button.
STOP LIMIT LOW ANGLE	A certain number of welds were performed outside the set limits. The last weld was performed with a conduction angle value lower than the min set limit.	Reset the error by pressing any button.
STOP LIMIT HIGH ANGLE	A certain number of welds were performed outside the set limits. The last weld was performed with a conduction angle value higher than the max set limit.	Reset the error by pressing any button.
STOP LIMIT MIN ENE TIME	The energy required during the welding has already been reached with the minimum weld time.	Reset the error as indicated and check the program to change some parameters such as ENERGY, POWER and MIN WELD and MAX WELD.
STOP LIMIT MAX ENE TIME	The energy that the control unit read during the welding is lower than that set.	Reset the error as indicated and check the program to change some parameters such as ENERGY, POWER and MIN WELD and MAX WELD.
MINIMUM LIMIT > MAXIMUM LIMIT	The value set in a minimum limit parameter (MIN CURR. or MIN CONDUC.) is higher than the value set in a maximum limit (MAX CURR. or MAX CONDUC.).	Change the parameter that generated the error.
SPOTS FINISHED DRESS ELECTRODES	The spots, programmed in the DRESS. SPOTS parameter, were reached.	Reset the error by pressing any button.
ENERGY MODE ELECTRODES ERROR	No voltage signal was detected at the electrodes during a work cycle in ENE WORK MODE.	Check the connection of the wires at the secondary winding of the weld transformer and the isolation transformer.

CHAPTER 13 – TECHNICAL SPECIFICATIONS

POWER SUPPLY: 24VAC +/- 10%

FREQUENCY: 50/60Hz +/- 1%

CONSUMPTION: 0.25A WITHOUT LOAD/ < 1A 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: 358g / 0.78925 lb

PROTECTION RATING: IP65

NOTES

NOTES

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