

# DIGITAL TEMPERATURE ADJUSTMENT SYSTEMS TYPE 384

**BRAMA**

**CONTROL BOARD FOR AUTOMATIC-  
IGNITION ATMOSPHERIC BOILERS,  
WITH IN BUILT E.M.C. FILTER AND  
REMOTE IGNITION DEVICE.**



## DESCRIPTION

These electronic systems are suitable for operating cycle and temperature control in closed-chamber and open-chamber atmospheric gas boilers.

## GENERAL FEATURES

This control board is provided with the following features:

- single electrode or double electrode ignition and flame monitoring (ionization) system with remote ignition device;
- possibility of multiple ignition attempts;
- control of the boiler parts (system circulator, modulating gas valve, deflection valve, flow switch/flowmeter, air pressure switch, thermostats, etc.);
- controls, adjusters and signals on a customized module connected to the mother board by means of a flat cable;
- electrical reset (with lockout status storage in the EEPROM) or manual reset;
- use of NTC contact and/or immersion probes for temperature measurement (up to 4 probes);
- microcontroller-based control of temperature adjustment and ignition and flame monitoring functions;
- SELV (Safety Extra Low Voltage) insulation;
- flame modulation by means of a proportional, integral and derivative (PID) electronic system;
- differentiated setting of the required water temperature for heating and domestic hot water operation mode;
- adjustable boiler max. heat capacity in heating mode;
- domestic mode priority by means of a flowmeter/flow switch;
- pump overrun and lockout prevention and deflection valve lockout prevention;
- post-purge function;
- temperature safety limit in the boiler primary hydraulic circuit;
- prearranged for connection to electromechanical limit and safety thermostats;
- prearranged for use in floor heating systems;
- diagnostic functions: heat demand signal, boiler lockout, probes cut-off, lack of water in the system, lack of stack draft;
- EMC system approved according to the standard EN298;
- prearranged for burner heat capacity modulation through gas solenoid valve modulation;
- prearranged for pump speed modulation according to the system characteristics;
- varistor protecting from voltage transients which may be generated in the mains supply;
- outgoing water temperature adjustment program by means of an outside probe;
- operation independent from live-neutral connection and suitable for live-live systems;
- RS232 and RS485 interface.
- Opentherm protocol compatible.
- possible cascade connection.

## TECHNICAL DATA

<b>Supply voltage:</b>	220/240Vac-50/60Hz
<b>Operating temperature range:</b>	-10°C +60°C
<b>Humidity:</b>	95% max. at 40°C
<b>Protection degree:</b>	IP 00
<b>Fuse current:</b>	2A – quick acting
<b>Consumption (without loads):</b>	10W
<b>Dimensions:</b>	140mm X 100mm (h 45mm)

## CONSTRUCTION

The system consists of the following operating units:

1. **Mother Board (SM)**, including power supply and a microcontroller for temperature adjustment and ignition and flame monitoring functions;
2. **Relay Module (MR)**, on which the relays of the board are mounted;
3. **Expansion Board (SE – optional)** enabling the expansion of the board with the addition of connections type RS232, RS485, Opentherm, etc. (this module is not described in this data sheet; for information please refer to the relevant product documentation).

The system is equipped with a **Control Panel (TC)**, which is connected to the Mother Board (SM) by means of a flat cable and represents the user's interface (push-buttons, potentiometers, LEDs, 7-segment display, LCD).

This system can be fitted to a remote ignition device type **TR2**.

## ACCESSORIES

The system can be supplied complete with Brahma contact temperature probes type ST03, ST04, ST07, or immersion temperature probes type ST06, ST6B, ST09 and ST11.

For a description about temperature probes, please see the relevant data sheets.

## INTEGRATED TEMPERATURE ADJUSTMENT SYSTEM

The main functions of the board are mentioned below.

### Gas valve modulator current control:

Natural Gas Range Current:	20..130mA
LPG Range Current(*) :	25..170mA

(\*) with J12 closed

### Type of lockout

Volatile lockout (Standard) or Non-volatile lockout.

### Times (\*):

Prepurge time (TP)	0 - 120s
Safety time (TS)	3 - 120s
Spark ignition time (TSP)	TS –1
Drop-out time on flame failure	<= 1 s
Ignition attempts	1-10

(\*) The above times correspond to guaranteed values. Actual values may differ from declared ones, as waiting (TW) or prepurge time (TP) may be longer and safety time (TS) shorter.

### Load rating:

Gas valve (EV)	0,25A $\cos \varphi \geq 0.5$
Fan	0.5A $\cos \varphi \geq 0.5$
Electrical pump	0.5A $\cos \varphi \geq 0.5$
Deflection valve	0.5A $\cos \varphi \geq 0.5$
220Vac modulating output	0.5A $\cos \varphi \geq 0.5$

**NB:** The board is provided with an input filter; the total load current allowed by the board is 2 A; therefore the total load must be lower than or equal to this value. Therefore the sum of applied loads has to be lower than 2A.

### Flame monitoring:

The flame detection device makes use of the rectification property of the flame.

Min. ionisation current:	0.5µA (*)
Recommended ionisation current:	3 ÷ 5 times the min. ionisation current
Max. cable length:	1m

(\*) A sensitivity of 1,2 µA is also available.

### Ignition device

The ignition device is remote (type Brahma TR2).

Type:	TR2
Peak voltage with 30 pF load:	15KV or 18 kV
Peak current:	800 mA
Spark frequency:	12 – 25 – 50 Hz (different frequencies are available on request)
Supply cable standard length:	0.6 m (different lengths are available on request)
High voltage cable standard length:	0,2 m (different lengths are available on request)
Silicone high voltage cable with diameter:	4mm
Electrode connection:	cylindrical $\varnothing$ 4mm (configuration upon request)
Recommended spark gap:	2-4 mm
Consumption:	2,5VA
Spark energy	20mJ
Max. operating temperature:	150°C

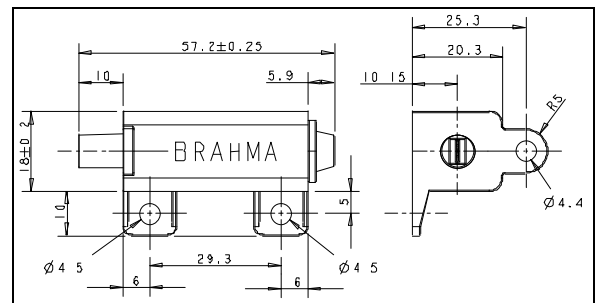


fig.1. Remote Ignition Device: BRAHMA Type TR2

#### - Temperature measuring probes

The system operates with one or two or three temperature measuring probes. The BRAHMA contact probes type ST06 we usually employ enable great manufacture and service advantages and guarantee the same performance as immersion sensors. In case of short-circuit or interruption of the operation of one of the probes, depending on the type of boiler the temperature adjustment system can either operate with the remaining probe, signalling a failure, or cancel any heat demand, preventing the boiler from operating. The probe fitted to the primary circuit also acts as limit thermostat, thus allowing any heat demand to be cancelled if the water temperature exceeds the preset limit temperature.

#### - Safety thermostat

In general, the boiler is perfectly safe against possible overheating in the primary circuit by means of a safety thermostat connected on the SM and in series to the gas valve control. The thermostat stops the gas flow and consequently extinguishes the flame; then a starting attempt occurs followed by lockout. Before trying to start a new ignition cycle, is necessary a manual reset.

#### - Limit thermostat

This thermostat is read by the micro and when it open the system stop the gas flow with consequently extinguishes the flame and the control board display the error state.

#### - Air pressure switch (for closed-chamber boilers only)

It checks the circulation of combustion products in the combustion chamber and allows boiler ignition only if the fan is operating and the draft is regular; it also ensures the boiler safety shutdown if one of these conditions fails during operation. Upon request, in open-chamber boilers the air pressure switch can be replaced by a combustion products discharge safety device using the same connector but another pin. For the connection see the wiring diagram section.

#### - Water pressure switch

It ensures that the primary circuit pressure is within the required operation range. In case the pressure is too low, the temperature adjustment system cancels any heat demand and the type of failure appears on the power switch board.

#### - Water pressure trasducer

It ensures a reading of the primary circuit pressure. The value of the pressure is displayed in the control board. In case the pressure is too low, the temperature adjustment system cancels any heat demand and the type of failure appears on the power switch board.

#### - Water flow switch

The SM is prearranged for an input connection signalling domestic water drawing. This signal can be generated by a flow sensor (flow switch or flowmeter): in this case the three-way valve (if available) is electrically controlled by the system; otherwise the signal can be generated automatically by an hydraulic three-way valve.

#### - Room thermostat

The room thermostat (or chronothermostat) is connected to the SM by two wires; it is designed to operate with a contact isolated from the power supply line.

#### - Timer

The SM is provided with a connection for a timer (12-24V or 220V) mounted on the board to adjust the heating time, as required by the new standards regarding energy saving. Thanks to this timer, the use of a chronothermostat is not required.

#### - External probe

The system is prearranged for the connection to an NTC sensor (similar to the one used in temperature probes), which measures the external temperature outside the building in which the installation is placed. The available adjustments in heating mode are the required ambient temperature and the heat dispersion coefficient of the room walls. The temperature appearing on the display is the primary circuit temperature, resulting from the two preset parameters and the external temperature. Upon variation in the latter one, the primary circuit temperature changes automatically to adjust the ambient temperature according to the preset value.

#### - Control board

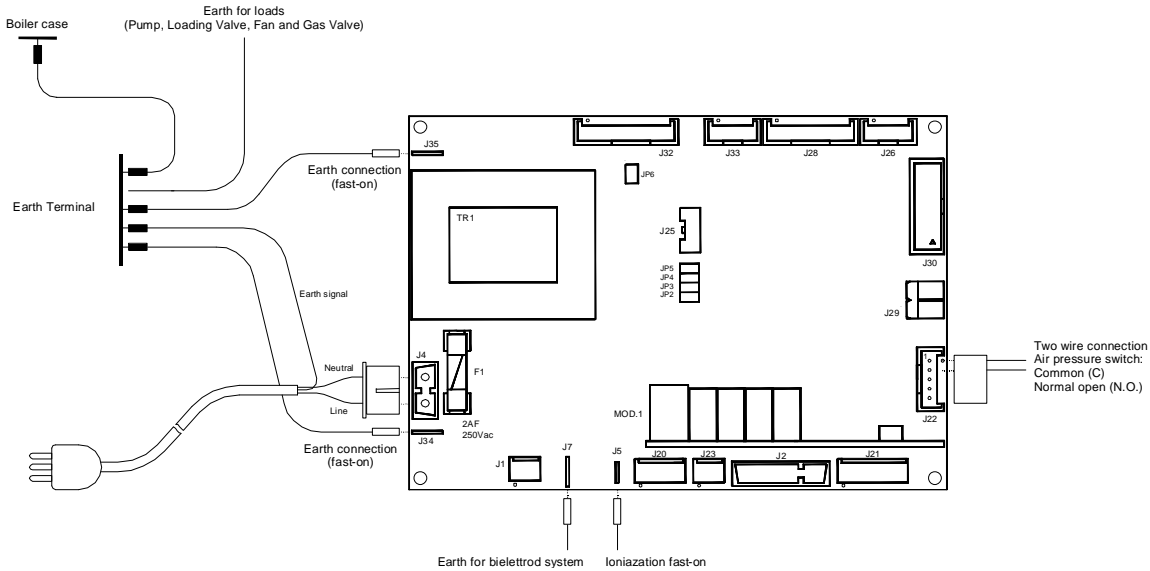
This mother board supply more types of control board with 7 segment display or LDC, with push-buttons or regulator trimmers.

**NB:** All the custom characteristics are describe in the customer use manual.

#### DIRECTIONS FOR INSTALLATION

- Respect the applicable national and European standards (e.g. EN60335-1/prEN50165) regarding electrical safety.
- Connect **live** and **neutral** correctly; the non-observance of live-neutral polarity may cause a dangerous situation. Polarity must be respected even in case the board is in non-polarized version.
- The earth of the board must coming from the star earth of the boiler, not directly from the earth-line. The board-earth is not safety but only functional. The earth signal must be connected as shown in the figure below
- Before starting the system check the cables carefully; a wrong wiring can damage the devices and compromise the safety of the installation.
- Connect and disconnect the control system only after switching off the power supply.
- The system can be mounted in any position.
- Avoid exposing the system to dripping water.
- The appliance in which this temperature adjustment system is mounted must provide adequate protection against the risk of electric shock (at least IP20).
- Avoid placing control signal cables close to power cables. Avoid placing ignition cables close to other cables.

## Earth connection



## OPERATING CYCLE

The following operating cycle refers to the temperature adjustment system described above.

This operating cycle refers to a standard example and can be customized upon request. The cycle refers to a board fitted with the control panel illustrated in fig.2.

### Starting cycle

The starting cycle begins on heat demand by the room thermostat (heating mode) or the water flow switch (domestic hot water mode).

The water pump is energized, and if the water temperature is lower than the preset value, a burner starting demand will occur.

In case of a closed-chamber boiler, the control unit starts the fan only if the air pressure switch is in "no-air-flow" position; when it switches into "air-flow" position, the prepurge time TP begins, at the end of which the gas valve is supplied, the ignition device is started and the safety time TS begins. In this stage, the burner heat capacity is kept at a controlled value according to the application requirements (soft start).

If a flame signal is detected at the end of TS, the temperature adjustment process will begin, and the burner flame will be modulated in order to reach the same water temperature as the preset value. If no flame signal is detected within the safety time, on the elapsing of TS the gas valve will close. If the number of attempts is completed the lockout condition occurs, otherwise there is another ignition attempt. The boiler lockout is signalled on the control panel; to reset the system press the corresponding push-button. If hot water demand still occurs, the boiler will start a new ignition cycle; if the conditions leading to lockout still occur, the boiler will go back to lockout. The boiler keeps on running until either heat demand stops, or

one of the safety devices switches on, or the flame extinguishes.

### Domestic hot water mode

Ignition demand in DHW mode has priority over heating mode. The boiler burner ignition occurs when hot water is drawn; the boiler will try and supply the user with domestic hot water at preset temperature. If the required capacity is lower than the min. modulation capacity, the boiler will perform short ignition and turnoff cycles. If the required capacity is higher than the boiler max. capacity, the water temperature will be proportional to the quantity of drawn water, but lower than preset temperature.

### Heating mode

If the boiler is in winter position, and on room thermostat switching off the outgoing water temperature is lower than the preset value, boiler ignition will occur and flame modulation will begin until the boiler reaches the running condition. If the outgoing water temperature is 5°C higher than the value previously adjusted by the user, the boiler will switch off; re-ignition occurs as soon as the water temperature drops of 5°C below the preset value, provided that at least 150 sec have elapsed from the boiler switching off. The boiler max. capacity in heating mode is set during installation through the push-buttons on the control panel.

### Circulator overrun

Every time the boiler switches off (in heating mode), the circulator keeps on running for a short time (5 seconds), in order to avoid water overheating in the primary heat exchanger. Suggested overrun times are, for example: 30s, 60s or 180s.

## WIRING DIAGRAM

The wiring diagram is illustrated in fig. 3 at the end of this paragraph. Followings are the connectors of the board and the meaning of each signal  
if some of the loads are not available, the corresponding pins or all the connector may not be fitted.

<b>Board power supply connector (J4 – 2-POLE STELVIO)</b>	
Pin 1	Live
Pin 2	Neutral

<b>Earth connectors (J7, J34, J35 – 6,3 mm fast-on)</b>	
Pin 1	Earth

<b>Flame sensor connector (J5 – 4,8 mm fast-on)</b>	
Pin 1	Flame sensor

<b>High-voltage load connector for diverting valve (J20 – 9-POLE MOLEX)</b>	
Pin 1	Neutral
Pin 2	NC
Pin 3	NO

<b>Fan connector (J23 – 2-POLE MOLEX)</b>	
Pin 1	Neutral
Pin 2	Fan (on/off)

<b>Pump and modulating load connector (J21 – 4-POLE MOLEX)</b>	
Pin 1	Water electrical circulator
Pin 2	Neutral
Pin 3	Neutral
Pin 4	230Vac auxiliary control

<b>Gas valve connector (J2 – 4-POLE STELVIO CFM4A)</b>	
Pin 1	Live for EVG gas valve
Pin 2	Safety thermostat
Pin 3	Safety thermostat
Pin 4	Neutral for EVG gas valve

In case no safety thermostat is used, connection is as follows:

<b>Gas valve connector (J2 – 4-POLE STELVIO CFM4A)</b>	
Pin 1	Not connected
Pin 2	Not connected
Pin 3	Live for EVG gas valve
Pin 4	Neutral for EVG gas valve

<b>Air pressure switch and limit thermostat connector (J22 – 5-POLE LUMBERG 2,5MSF) Closed-chamber connection</b>	
Pin 1	Air pressure switch
Pin 2	Air pressure switch
Pin 3	Not connected
Pin 4	Limit thermostat (*)
Pin 5	Limit thermostat

(\*) If no limit thermostat is used, pins 1 and 2 must be short-circuited.

<b>Connector for combustion products safety device and limit thermostat (J22 – 5-POLE LUMBERG 2,5MSF) Open-chamber connection</b>	
Pin 1	Combustion products discharge safety device (*)
Pin 2	Not connected
Pin 3	Combustion products discharge safety device (*)
Pin 4	Limit thermostat
Pin 5	Limit thermostat

(\*) If no combustion products safety device is used, pins 1 and 3 must be short-circuited.

<b>Modulation and flow switch connector (J32 – 9-POLE LUMBERG 2,5MSF)</b>		
	<b>FLOWMETER</b>	<b>FLOW SWITCH</b>
Pin 1	NOT USED	NOT USED
Pin 2	NOT USED	NOT USED
Pin 3	EVG valve modulator	EVG valve modulator
Pin 4	EVG valve modulator	EVG valve modulator
Pin 5	Water pressure switch	Water pressure switch
Pin 6	Water pressure switch	Water pressure switch
Pin 7	Flowmeter input	Flow switch
Pin 8	Flowmeter +5Vdc	Not connected
Pin 9	Flowmeter 0Vdc	Flow switch

In case the option "modulating fan low-voltage PWM control" is operating (in this case the air pressure switch is necessary), the connector is the following:

<b>Modulation and flow switch connector (J32 – 9-POLE LUMBERG 2,5MSF)</b>		
	<b>FLOWMETER</b>	<b>FLOW SWITCH</b>
Pin 1	Modulator +24Vdc	Modulator +24Vdc
Pin 2	Modulator 0Vdc	Modulator 0Vdc
Pin 3	EVG valve modulator	EVG valve modulator
Pin 4	EVG valve modulator	EVG valve modulator
Pin 5	Water pressure switch	Water pressure switch
Pin 6	Water pressure switch	Water pressure switch
Pin 7	Flowmeter input	Flow switch
Pin 8	Flowmeter +5Vdc	Not connected
Pin 9	Flowmeter 0Vdc	Flow switch

In this application is necessary the use of the Air Pressure Switch.

<b>Pressure transducer connector (J33 – 4-POLE LUMBERG 2,5MSF)</b>	
Pin 1	+5Vdc
Pin 2	0Vdc
Pin 3	+24Vdc
Pin 4	Input

<b>NTC temperature sensor connector (*) (J28 – 8-POLE LUMBERG 2,5MSF)</b>	
Pin 1	Outside NTC
Pin 2	Outside NTC
Pin 3	Heating return NTC
Pin 4	Heating return NTC
Pin 5	Domestic hot water NTC
Pin 6	Domestic hot water NTC
Pin 7	Heating NTC
Pin 8	Heating NTC

(\*) The function of NTCs is determined by the temperature adjustment program. This function can vary according to specific customer's requirements.

<b>Room thermostat connector (J28 – 2-pole screw connector)</b>	
Pin 1	Room thermostat
Pin 2	Room thermostat

<b>Selection jumpers</b>	
JP6	LPG/Natural gas
JP2	Customizable (*)
JP3	Customizable (*)
JP4	Customizable (*)
JP5	Customizable (*)

(\*) The function of jumpers is determined by the temperature adjustment program. This function can vary according to specific customer's requirements.

<b>Timer connector (J26 – 4-POLE JST)</b>	
Pin 1	0Vdc
Pin 2	+24Vdc
Pin 3	Input/output TTL 1
Pin 4	Input/output TTL 2

The remaining connectors have the following function:

1. J30: connector for interface control panel connection;
2. J25: connector for in-circuit programming of U9;
3. J8, J9, J10, J11, J12: connectors for expansion board connection (SE).

In particular, J30 connects the board to the control panel, if available. An example of control panel is shown in fig.2.

In general the board can drive up to 4 seven segments displays and it can read up to 7 push-buttons.

The meaning of each push-button can be determined by the temperature adjustment program.

Only the reset button has to be fixed (as shown in fig.2).

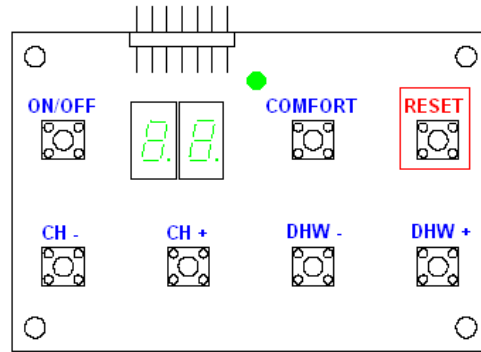


fig.2. An example of interface control panel

## PART REFERENCES

Type	description		
384	(1) (2) (3) (4) (5) (6) (7) (8) . (9) (10) (11)		
(1)	Power supply: P: Phase-sensitive device N: No phase-sensitive device	(7)	Modulation: D: No modulation
(2)	Interfaces : E: Economical C: Expansion type 386	(8)	Thermostat: Y: No room thermostat
(3)	Communication : S: number of standard inputs M: Multiplexer	(9)	Letter refers to a customer: (Brahma document)
(4)	Type of control board : 0: No control on board 1: LCD 2: 2 digits 3: 3 digits 4: 4 digits	(10)	Type of software: 0, 1, 2....: progressive numbering
(5)	Type of control circulator : X: Nothing F: Phase-shift U: Output 220V	(11)	Software index revision: 00, 01, 02.....: progressive numbering
(6)	Deflection relays: 1: Fan relay – no deflection valve relay 2: Fan relay – deflection valve relay 3: No fan relay – no deflection valve relay 4: No fan relay – deflection valve relay		

## PARTS REFERENCES OF THE BOARD OPTIONS

### Options (printed on the label)

(1) (2) (3) (4) (5) (6) (7)

### Options descriptions

- (1) M: manual reset  
E: electrical reset (standard)
- (2) TP: 0-120s (standard 3s)
- (3) TS: 3-120s (standard 7,5s)
- (4) Fan:  
F1: without fan (open chamber)  
F2: with fan  
F3: with fan (open/close chamber compatible) (standard)
- (5) Power supply connection  
No letter: phase-neutral polarization (phase-sensitive control).  
N: no-polarization (one independent phase relay and one independent neutral and flame detection relay for no-polarized ionization) (standard).  
N1: one independent phase relay and one independent neutral and flame detection relay for polarized ionization
- (6) Ignition attempts  
No letter: one ignition attempt after a safety shutdown (standard).  
Ynn: multiple ignition attempts (nn = 1 – 10)
- (7) Ignition device and flame detection mode  
No letter: remote ignition device (TR2) and flame detection through a dedicated electrode  
X1: remote ignition device (TR2) and single-electrode flame detection (one electrode for both flame detection and ignition)

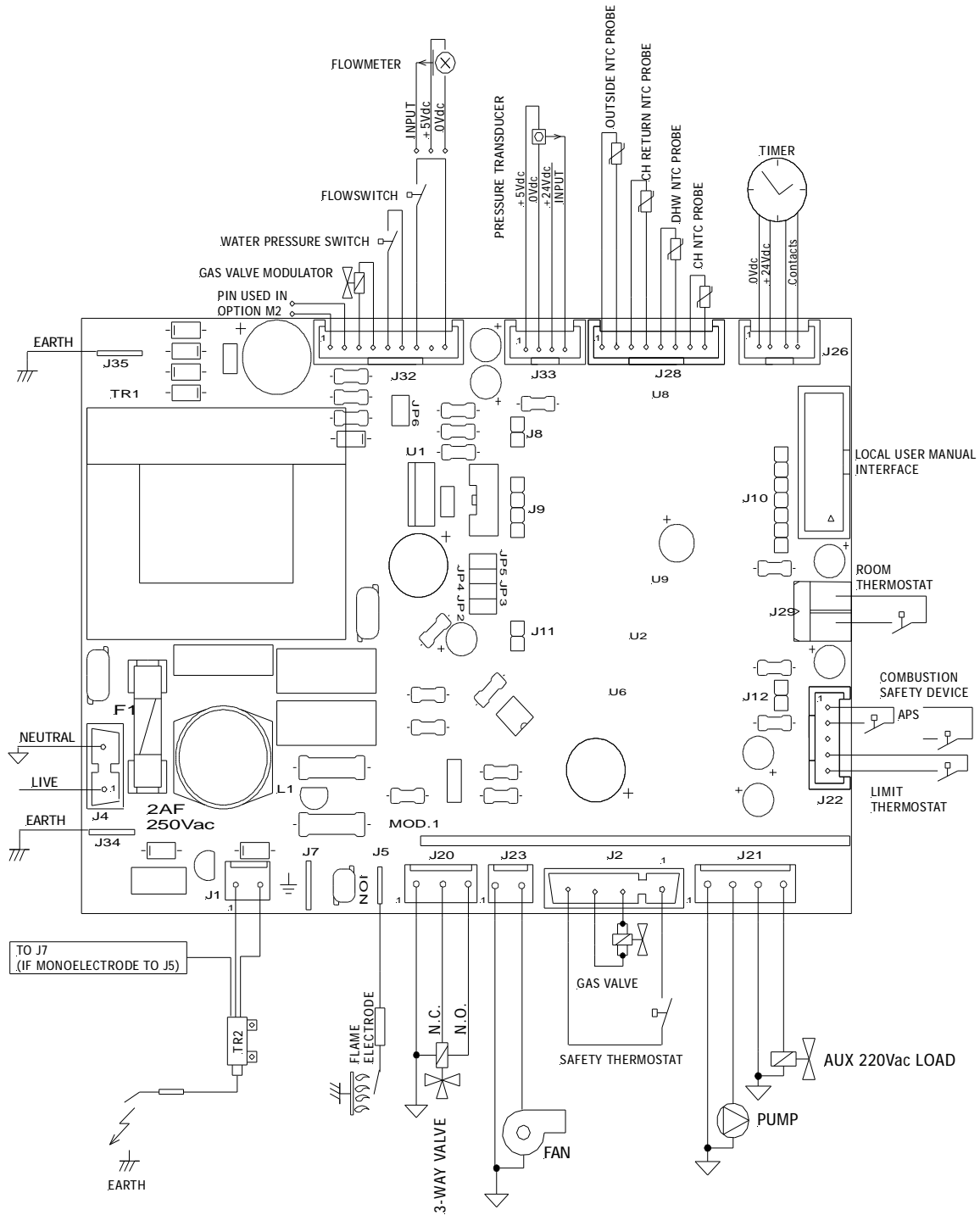


fig. 3. 384 Wiring diagram (the dimensions are not in scale)

**ATTENTION -> Company Brahma S.p.A. declines any responsibility for any damage resulting from the Customer's interfering with the device**

**BRAHMA S.p.A**  
 Via del Pontiere, 31/32  
 37045 Legnago (VR) - ITALY  
 Tel. +39 0442 635211 – Fax +39 0442 25683  
 http://www.brahma.it  
 E-mail: brahma@brahma.it

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