DIGITAL TEMPERATURE ADJUSTMENT SYSTEMS TYPE 354 WITH REMOTE CONTROL BOARD TYPE 364

DESCRIPTION

These electronic systems are suitable for temperature control in closed-chamber or open-chamber wall hung boilers fitted with atmospheric gas burners.

GENERAL FEATURES

Temperature adjustment systems are usually manufactured on customer's request according to the type of boiler, the components used and the operation specifications. In general, these systems are provided with the following features:

- single electrode or double electrode ignition and flame monitoring (ionisation) system fitted with remote ignition device;
- control of the boiler parts (pump, fan, deflection valve, flow switch, air pressure switch, thermostats, etc.);
- controls, adjusters and signals on a remote control board connected to the mother board by means of a bipolar cable (length up to 20 m);
- use of contact or immersion probes for temperature measurement, exploiting the resistivity characteristic of NTC components;
- temperature adjustment function control by means of a microcontroller;
- 4kV and 8mm SELV (Safety Extra Low Voltage) insulation on the printed circuit board surface between components connected to the mains supply and low voltage controls;
- 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 setting of the boiler max. heat capacity in heating mode;
- domestic mode priority by means of a (power-driven or hydraulic) three-way valve or a flowmeter;
- pump overrun and lockout prevention and deflection valve lockout prevention;
- antifreeze function;
- cancellation of the heat demand in case of interruption of the signal emitted by temperature measuring probes;
- fixed safety limit of the boiler primary hydraulic circuit temperature;
- connection to a safety limit thermostat;
- prearranged for use in floor heating systems;
- prearranged for use with LPG or natural gas;
- diagnostic functions: heat demand signal, boiler lockout, probes cut-off, lack of water in the system, lack of stack draft;
- EMC system.

TECHNICAL DATA

Supply voltage:	230V-50/60Hz
Operating temperature range:	-20°C +60°C
Humidity:	95% max. at 40°C
Protection degree:	IP 00
Dimensions:	140x100x44mm

CONSTRUCTION

The system consists of three units (electronic boards):

a) **Mother Board (SM)**, which houses the boiler control and the connections to the remaining components;

b) **Ignition and Control Module (ACF)**: this board, carrying out the burner safety functions, can control a single electrode or double electrode system, and is mounted directly on the mother board by soldering, thus reducing the number of wires on the power switchboard; the surface of this board is protected with epoxy resin to prevent possible damages resulting from incautious handling or external agents such as dust or humidity;

c) **Control Board (SC)**, on which adjustment controls (push-buttons) and diagnostic signals (on a display) are mounted.

The above units are fitted to a **Remote Ignition Device (AR)** controlled by ACF, reducing electromagnetic interference and enabling the system to fully comply with electromagnetic compatibility standards without using any filters. (for technical characteristics, see our data sheets “REMOTE IGNITION TRANSFORMERS TYPE TR2”).

The use of non-reversible connectors with a different number of poles makes connection easy and reliable. A varistor protects the components from possible voltage transients in the mains supply.

An inbuilt fuse protects the internal relays in case of short circuit on the control outputs.

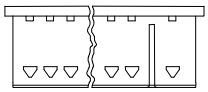
ACCESSORIES

The system can be suppied with:

- connectors and terminals for wiring (see Fig.1);
- contact temperature probes (type ST03, ST04 and ST07);
- immersion temperature probes (type ST06 and ST09).

For the technical characteristics of the probes, see relevant data sheets.

As for the connectors, pay attention not to fit terminals and female connectors of different brands.



FEMALE CONNECTORS
STOCKO: MKF 2800
STELVIO:BS95/...

TERMINALS
STOCKO: RFB 7851
STELVIO: CT84

Fig.1

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.
– 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 IP 20).
– Avoid placing control signal cables close to power cables.

INTEGRATED TEMPERATURE ADJUSTMENT SYSTEM

Integrated temperature adjustment systems are usually manufactured on customer's request as far as operation and control of the boiler parts are concerned. For a more detailed description, we will refer to a particular type, the main features of which are shown in Fig. 2. The integrated temperature adjustment system we are going to consider consists of the following components:

- **Ignition and Control Module (ACF)**
  Timings:

- waiting or prepurge time **(TW):**	1,5 … 40 s
- safety time **(TS):**	3 … 60 s
- drop-out time on flame failure:	< 1 s

The above times correspond to guaranteed values. Actual values may differ from declared ones, as waiting or prepurge time may be longer and safety time shorter.

- **Power consumption, start-up:**

- open chamber	18VA
- closed chamber	20VA

- **Power consumption, running:**

- open chamber	15VA
- closed chamber	17VA

- **Max. contact rating:** (contacts mounted on SM)

- VG1 gas valve:	0.5A	$\cos\varphi \geq 0.4$
- Fan:	1A	$\cos\varphi \geq 0.4$

- **Max. cable length of external components:** 1 m

- **Max. length of the cable connecting control board and mother board:** 20 m

- **Internal fuse:** 3.15 A quick acting

Flame monitoring:

The flame detection device makes use of the rectification property of the flame; this device is not provided with any protection impedance, therefore the detection electrode is not safe against electric shock.

- Min. ionisation current:	0.5µA
- Recommended ionisation current:	3÷5 times the min. ionisation current
- Max. cable length:	1 m
- Min. insulation resistance of detection electrode and cable to earth:	≥ 50 MΩ
- Electrode max. stray capacitance:	≤ 1 nF
- Max. short circuit current:	< 200µA AC

♦ **MOTHER BOARD (SM)**

- **Temperature measuring probes**
  The system operates with one or two temperature measuring probes, depending on the type of boiler. For boilers for heating only, the system only uses the heating probe (SR), which is usually placed on the output pipe of the boiler heat exchanger. For boilers for domestic hot water production, the system also uses the domestic probe (SS), which is usually placed on the output pipe of the domestic circuit. In case of short circuit or cut-off 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 heating circuit (SR) also operates as limit thermostat, thus stopping any heat demand if the water temperature exceeds the preset limit temperature.

- **Safety thermostat**
  In general, the boiler is perfectly safe against possible overtemperature in the primary circuit: to this purpose, a safety thermostat is used, which is connected to the mother board (SM) in series to the gas valve. The thermostat stops the gas flow and consequently extinguishes the flame; then a starting attempt occurs followed by non-volatile lockout.
  Before trying to start a new ignition cycle, reset the system manually.

- **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.

- **Water pressure switch / Pressure transducer**
  It ensures that the primary circuit pressure is within the required operation range. In case the pressure is too low, the temperature adjustment system stops any heat demand and the type of failure appears on the control panel. In case a pressure transducer is used, the pressure level can be displayed on the control panel through 5 LEDs.

- **Water flow switch / Flowmeter**
  The SM is provided with an input for the connection of either a water flow switch or a flowmeter signalling domestic water drawing. The deflection three-way-valve (if available) can be automatic (hydraulic) or electrically controlled by the system.

- **Room thermostat**
  The room thermostat is connected on the remote control board (SC) by two wires; it is designed to operate with a contact isolated from the mains supply.

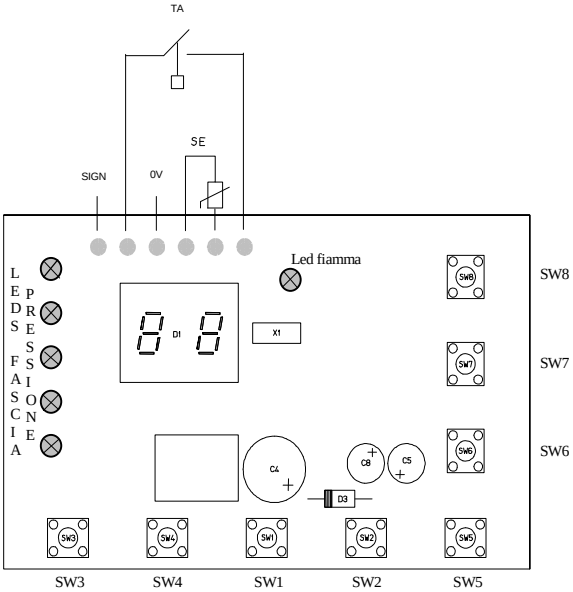
- **External probe**
  The control board (SC) is prearranged for the connection to an NTC sensor (similar to the one used in temperature probes), which measures the temperature outside the building in which the installation is placed. The available adjustments for the user in heating mode are the required room temperature and the heat dispersion coefficient of the room walls. The temperature appearing on the display is the temperature measured by the primary circuit probe, and in running state it will have the same value as the set-point resulting from the processing of the two preset parameters and the outside temperature. Upon variation in the latter one, the primary circuit set-point changes automatically to reach the preset room temperature.

Functions of the mother board

- **Setting functions during installation**
  During the boiler installation, some system functions are usually set (see below), which are mainly related to the features of the system itself. Please note that these settings are only possible through the jumpers J16-19, therefore they cannot be carried out by the user once the boiler has been closed.

- **Function of jumpers** (Fig. 2)
  The mother board is provided with a number of jumpers to fit the temperature adjustment system to the final installation:
  J7 must be inserted for LPG systems;
  J16 in position **0**: the user's normal functions (domestic hot water mode, heating mode, summer/winter selection) are available on the control board (SC); if J16 is placed in position **1**, the parameters which are useful during setting can be adjusted;
  J17 in position **0**: it requires a delay of at least 2,5 min. between a turnoff and subsequent re-ignition in heating mode; if J17 is placed in position **1**, re-ignition occurs as soon as the temperature drops of 5°C below the preset value;
  J18 in position **0**: it enables heat adjustment in traditional systems (variable from 30 to 80°C); placed in position **1**, it enables heat adjustment in floor heating systems (variable from 15 to 40°C);
  J19 in position **0**: it adjusts domestic hot water temperature from 30 to 60°C; placed in position **1**, it selects hot water tank boilers or boilers for heating only.

♦ **REMOTE CONTROL BOARD (SC) (type 364)**



The control board is fitted with the following: eight push-buttons (enabling the user to carry out any adjustment and setting during installation), two displays (showing temperature, settings and failure signals), a LED signalling flame on, and five LEDs for system pressure indication (in case a pressure transducer is available); pressure ranges can be customized through the software.

- **Display**
  The two-digit display usually shows the current water temperature in heating or domestic mode; however, when pressing one of the push-buttons for water temperature adjustment, the display shows first the last preset temperature value and then the current temperature setting.
  If the adjustment functions required during installation are recalled, the display shows a percentage value indicating the adjustment level (0-99%).

- **Functions of remote control board push-buttons**
  The standard function of push-buttons with J16 in position 0 is the following:
  SW3 : heating set-point decrease
  SW4 : heating set-point increase
  SW1 : domestic set-point decrease
  SW2 : domestic set-point increase
  SW5 : Summer / Winter selection
  SW6 : available for particular functions
  SW7 : boiler reset
  SW8 : boiler ON/OFF

  If J16 is in position 1 (for the installer), the function of push-buttons is the following:
  SW3 : heating capacity decrease
  SW4 : heating capacity increase
  SW1 : soft-start decrease
  SW2 : soft-start increase
  SW5,SW6,SW7 : not working
  SW8 : boiler ON/OFF

  The "chimney-sweep" function can be switched on by pressing the two push-buttons SW8+SW5 simultaneously. The function can be switched off by pressing the push-button SW3.

  REMARK: the functions of push-buttons can be customized upon request.

OPERATING CYCLE

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

Starting cycle
The starting cycle begins on heat demand by the room thermostat (heating mode) or the water flow switch / flowmeter (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 TW 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 low value (slow ignition). 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 and lockout will occur. 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 domestic 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 (variable from 30 to 60°C). 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 (variable from 30 to 80°C), 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.

SYSTEM SELF-CHECK AND SAFEGUARD FUNCTIONS

The system is provided with some diagnostic functions signalling the boiler operation status and the type of failures which may occur.

Any failures are signalled on the remote control board according to the following table:

Display	Description
E 0 0	Internal system error (EEPROM)
E 0 1	Installation pressure < 0.5 bar
E 0 2	Lockout due to ignition failure
E 0 3	Faulty outgoing water probe (SM)
E 0 4	Faulty domestic water probe (SS)
E 0 6	Lack of air or combustion products discharge failure

Other functions are related to the installation safeguard:

- **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.

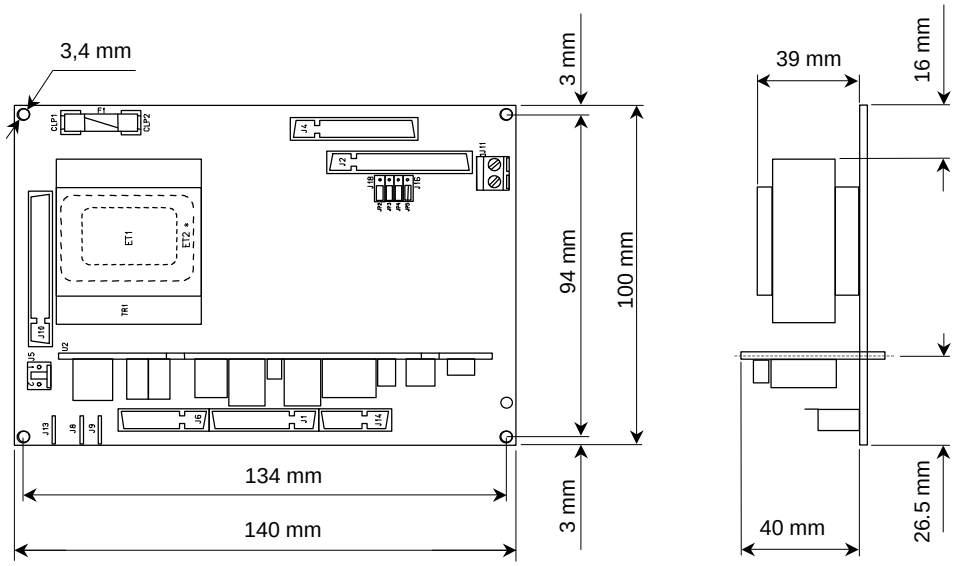
- **Circulator lockout prevention:**
  If the boiler has not carried out any ignition cycle within a given period of time (usually 24 hours), the circulator will switch on for a few seconds to avoid lockout due to protracted non-operation.

- **Antifreeze function:**
  When the system probe measures a temperature lower than 6°C, the burner starts at lowest power and the pump switches on. This status persists until a temperature of 20°C is reached.

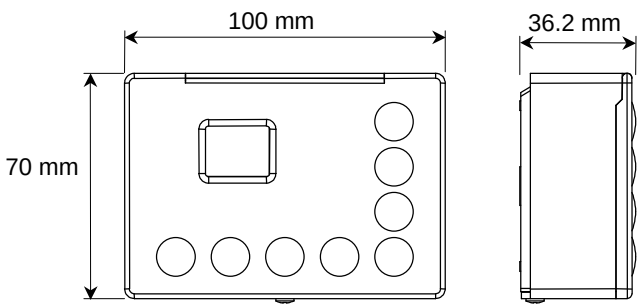
- **"Chimney-sweep" function:**
  This function is meant to switch off the boiler normal adjustment control, making the boiler work at max. available heat capacity. This function is useful during installation and when taking any combustion products checking measures, as required by the standards in force. This function can be switched off manually or on any domestic hot water demand.

DIMENSIONS

BOARD TYPE 354



CASING FOR CONTROL BOARD TYPE 364



WIRING DIAGRAM

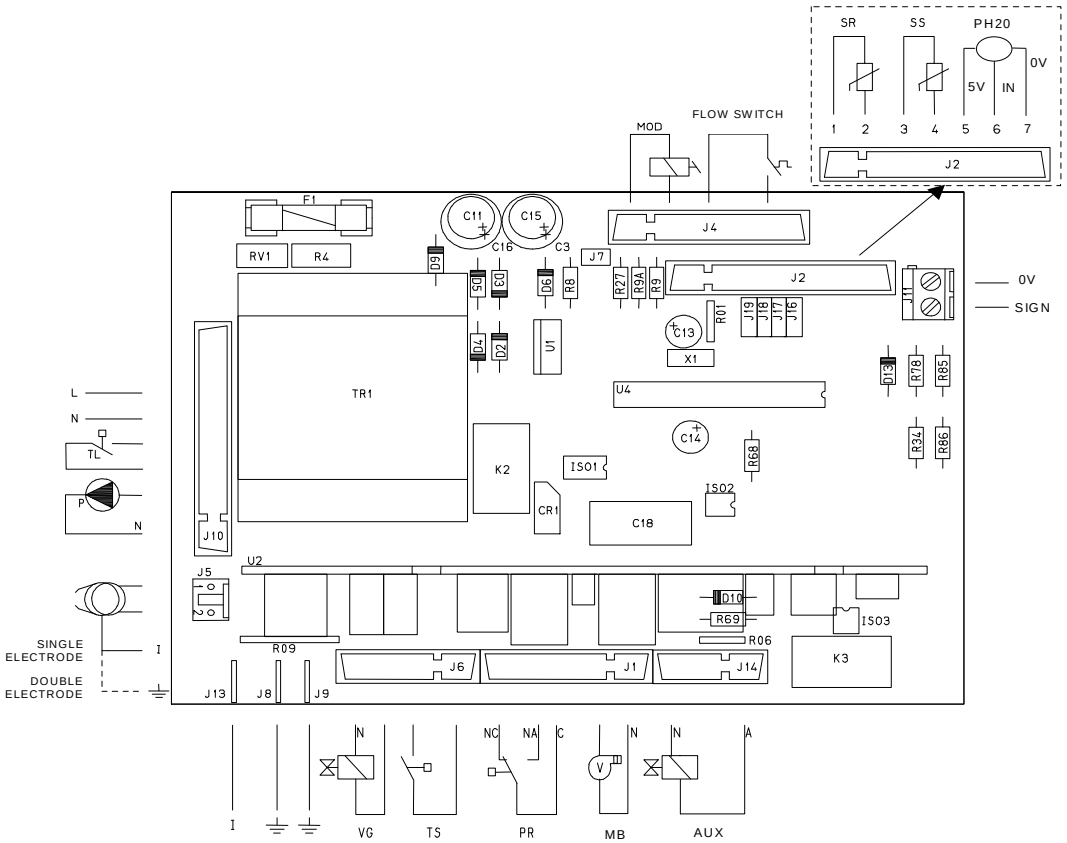


Fig.2

KEY

BOARD**:**

L	power supply line	SR	heating circuit probe	TR	ignition transformer
N	neutral	SS	domestic circuit probe	AUX	auxiliary output
P	pump	VG	gas valve		
U2	safety module	I	ionisation	TS	safety thermostat
TL	limit thermostat	MB	fan		
MOD modulator (24 V)		PR	air pressure switch		

PH2O water pressure switch (transducer)

0 - SIGN signals to be connected to the remote control board

FUNCTION OF JUMPERS

J7	LPG / natural gas	J16	installer's setting	J19	domestic temperature range / boiler type selection
J17	re-ignition interval	J18	floor heating system		

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