

cod. 7E-513-EN

QUICK INSTALLATION GUIDE

Side 1

- Warnings and safety
- Package Contents
- Display and keys
- Mounting
- Connections

Side 2

- Drilling dimensions and templates
- Technical specifications

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- ITALY -

WARNINGS AND SAFETY

Although all of the information in this manual has been carefully checked, Spirax S.p.A. assumes no liability regarding any errors or regarding damage to property and/or harm to individuals due to any improper use of this manual.

Gefran S.p.A. also reserves the right to make changes to the contents and form of this manual and to the characteristics of the devices illustrated at any time and without prior warning.

The installation of the devices illustrated in the manual must be carried out by qualified technicians in compliance with the laws and standards in force and in agreement with the instructions contained in the manual.

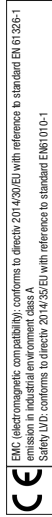
If the PID temperature controller 1650 is used in applications with the risk of damage to persons, machinery or equipment, it is essential to read the manual carefully. It is advisable to envisage the possibility of checking the intervention of the alarms during regular operation.

Before interacting with the PID temperature controller 1650, the operator must receive full training in the procedures of operation, emergency, diagnosis and maintenance of the system.

More information on the device and procedures of the installation, maintenance and use can be found in the installation and use controllers 1650-1650-1650, which is available for free download from the GEFAN website (www.gefran.com).

MAINTENANCE

Use a cloth dampened in ethyl alcohol or water to clean the front panel and the housing.
Do not use solvents derived from hydrocarbons (trichloroethylene, gasoline, etc.).



This is a Class A product intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility.

GRAPHIC SYMBOL

Indicates contents of sections, general instructions, notes, and other points to which the reader's attention needs to be called.
Indicates safety-related situations that could affect the safety or correct operation of the controller, or an instruction that MUST be followed to prevent hazards.

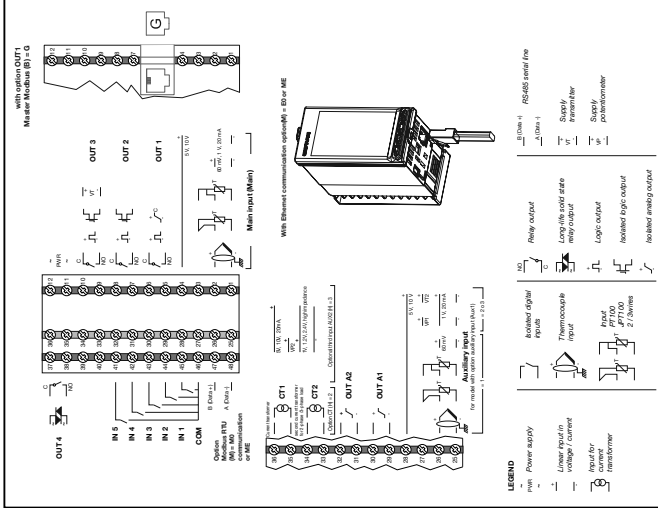
DISPOSAL

The 1650 controllers must be disposed of in conformity to current laws and regulations. If not correctly disposed of, some of the components used in the devices may harm the environment.

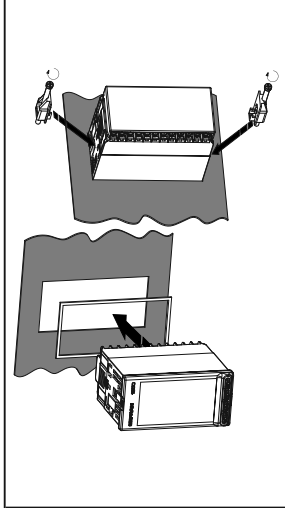
PACKAGE CONTENTS

- n. 1 PID Temperature Controller 1650
- n. 1 Mounting bracket with screws
- n. 1 Rubber gasket 48-98 front box
- n. 1 Instruction sheet

CONNECTIONS



- Insert the rubber gasket between the controller and the panel. The gasket (supplied) is indispensable for ensuring the declared protection index of the facelate.
- Insert the device into the hole previously made on the panel.
- Place the supplied bracket(s) on the rear of the controller.
- Tighten the screws to fasten the device to the panel. The tightening torque must be between 0,3 and 0,4 N.m.



Connected external circuits must have double isolation.
In case of shielded cables, the shield must be grounded at a single point, possibly near the controller.
Input cables must be physically separated from power cables, output cables, and power connections.
Do not connect terminal terminals.
Do not connect terminal terminals.
Loose terminals may cause sparks and fires. The recommended tightening torque is 0,5 Nm. When making electrical connections, please refer to the instructions of the manufacturer.
Do not bend or twist the cables beyond the limits specified by the manufacturers.

After connecting the cables, apply the transparent cover to protect the terminals. The terminal teeth limit and define the correct direction for applying the force. Always use cables appropriate for the voltage and current limits specified in the Technical Characteristics.

Use copper cables with 60°C/75°C insulation.
Use twisted and shielded cables for non-power connections.

For a connection data table of communication Ethernet 10/100Mbps, please refer to the standard minimum CAT5 con connector RJ45.

Connector	J1 and RJ45	Name	Description	Note
1	TX+	Data Transmission+		
2	TX-	Data Transmission-		
3	RX+	Data Reception+		
4	RX-	Data Reception-		
5	N.C.			
6	RX-	Data Reception-		
7	N.C.			
8	N.C.			

Cable type: use standard category 5 cable according to IEC61968

Per la versione dell'uscita OUT1 di tipo G "Master Modbus" utilizzare un connettore RJ10 criptico su cavo standard telefonico oppure cavo schematico 4x0.25mm² con la seguente pinatura.



The controller's terminal block has screw terminals (M3) that accept stripped cables and crimped terminals for a tightening torque of 0.5 Nm. Two ring or crimped fork terminals can be connected on each terminal.

Cable / terminal	Cable section / terminal	Terminal size
Rigid cable	0.8...2.5 mm ² (18...14 AWG)	
Twisted	0.8...2.5 mm ² (18...14 AWG)	
Ring terminal (to be crimped)	0.25...2.5 mm ² (23...14 AWG)	
Fork terminal (to be crimped)		5.8 mm
Ring terminal (to be crimped)		5.8 mm

Attention! Anchor the cables, at least in pairs, so that mechanical stresses do not discharge on the terminal connections.
Attention! Before powering the controller, make sure that the supply voltage matches the one shown on the controller data plate.

Because the controller does not have a switch, a bipolar switch with fuse must be inserted upline.
The switch, or isolator, must be positioned in the immediate vicinity of the device and must be easily reached by the operator.

The controller must be powered by a line separated from the one used for electromechanical power devices (relays, contactors, solenoids, etc.).
A single switch can control multiple controllers.
It is advisable to install a ferrite core on the power line, as close as possible to the device, to limit the controller's susceptibility to electromagnetic noise.

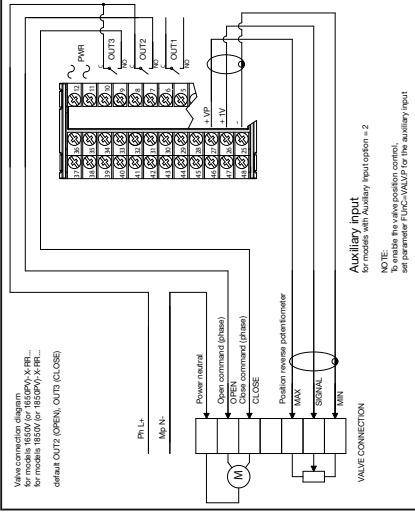
If the controller's power line is heavily disturbed by the switching of thyristor power units or by motors, it is advisable to use an isolation transformer for the controller, grounding the shield.
Use appropriate line filters in the vicinity of high-frequency generators or arc welders. Use a voltage stabilizer if there are wide shifts in line voltage.

2U...27 VAC/DC models must be powered by a class II or low-voltage limited-energy source. The power supply must use a line separator from the one used for electromechanical power devices, and low-voltage power cables must run along a path separated from the system of machine power cables.

- Attention!** Make sure the ground connection is efficient.
- Absent or inefficient grounding can make the device unstable due to excessive noise. Specifically, check that:
 - voltage between mass and ground is < 1 V;
 - resistance is < 6 Ω.

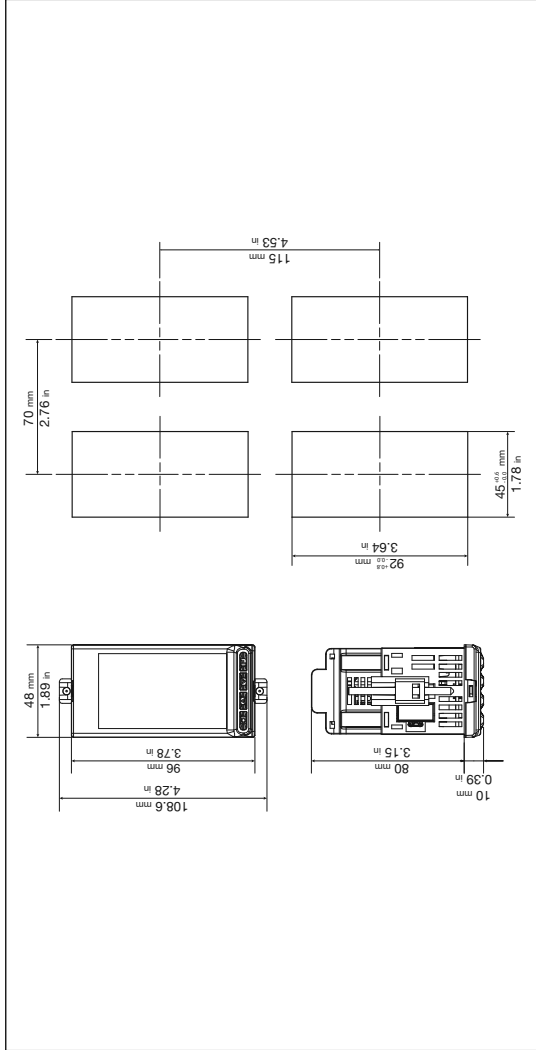
Attention! If the controller is connected to devices that are NOT electrically isolated (such as thermocouples), ground with a specific conductor to prevent grounding directly through the machine structure.

The controller's input and output lines must be separated from the power line.
To prevent noise, the controller's input and output cables must be kept away from the power cables (high voltages or high currents).
The input and output cables and the power cables must not be placed parallel to one another. Use shielded cables or separate cable trays.



Auxiliary input
for modes with Auxiliary Input option = 2
NOTE: the auxiliary input contact must be protected by a fuse (F) and a diode (D) for the auxiliary input.

DRILLING DIMENSIONS AND TEMPLATES



TECHNICAL DATA

ALARMS	POWER SUPPLY	CONTROL FUNCTIONS	CONTROL	SETPOINT PROGRAMMER (Double programmer if double loop)	MULTIPLE SETPOINTS	LOGIC OPERATIONS	MATHEMATICAL OPERATIONS	TIMER FUNCTION	ENERGY COUNTER	DIAGNOSTIC	RETENTIVE MEMORY
<ul style="list-style-type: none"> Number of alarm functions Possible configurations For sensor V1, V2 For potentiometer VP 	<ul style="list-style-type: none"> Number: 4 max Types of relay contact: NO Max. current: 5A (2A at ambient temperature up to 45 °C for certification UL), 250VAC / 30 VDC, $c_{sep} = 1$ Minimum load: 5 V, 10 mA Number of operations: > 500,000 @ 2A load current Isolation: 2500 V (with an external IFC suppressor (C-number) is recommended) Number: 2 max Types: for solid-state relays Voltage: 24 V ± 10% (min 10 V @ 20 mA) Isolated from main input Number: 2 max Types: MOS optoisolated for PLC inputs and AC/DC load Voltage: 30 V AC/DC max Current: 100 mA max Resistance ON: 0.8 Ω max Isolation: 1500 V Number: 1 max Types: relay Voltage: 24 VAC Current max: 1 A Isolation 3 kV snubber circuit integrated zero crossing switching Number: 1 max Current: 4...20mA Resolution: 12 bit $R_{in} < 500 \Omega$ Isolated from main input Number: 2 max 0...10 V max, 20 mA, $R_{in} > 500 \Omega$ 0...100 mA max, 20 mA, $R_{in} < 500 \Omega$ Resolution: 12 bit Isolated from main input 4 max, assignable to an output 	<ul style="list-style-type: none"> Type Control Control output Control output for motorized valves Number of programs Number of steps Number of setpoints Digital function blocks Analog function blocks Modes 	<ul style="list-style-type: none"> Types: ON/OFF Continuous or optimized (BF) OPR/OSES for flashing motorized valve or with feedback with position control by potentiometer on Relay, Solid-state, Trace outputs. Max 16 if double loop 8 + 8 (*) Start / Stop / Reset / Skip via digital inputs and/or outputs from logic operations Output state: Run / Hold / Ready / End Max 192, each with own setpoint, ramp time and hold time (**) Times settable in HR/MM or MM/SS Max 4 events, configurable in ramp and in hold Each setpoint change is subject to set ramp, different for up and down ramp 	<ul style="list-style-type: none"> 60 ms or 120 ms, selectable 0.0...20.0 s, configurable Rejection at differential mode: > 80 dB Rejection at common mode: > 150 dB Grab C / F, selectable on the keypad 60 ms or 120 ms, selectable 0.0...20.0 s, configurable Rejection at differential mode: > 80 dB Rejection at common mode: > 150 dB Grab C / F, selectable on the keypad 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	<ul style="list-style-type: none"> Types: 1989, 9908, settable decimal point Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V 	

GENERAL DATA	POWER SUPPLY	CONNECTIONS	AMBIENT CONDITIONS	PROTECTION LEVEL	ASSEMBLY	DIMENSIONS	WEIGHT	CE STANDARDS	CERTIFICATIONS
Operating voltage	100...240 VAC/VDC ±10%, 50/60 Hz (20...27 VAC/VDC ±10%, 50/60 Hz)	Serial configuration port	Altitude	IP 65 on front panel (as per IEC 60529)	Positioning	Weight	EMC conformity (electromagnetic compatibility)	CE, RoHS, REACH	UL, cUL
Power dissipation	10W max	RS485	Operating temperature	On panel, removable fasciplate	Installation regulations	Dimensions	LVD safety	USA, Canada	EAC
Connections	Over voltage 300 V / 25 V	Modbus RTU (option)	Storage temperature	Installation category: II	Isolation category: II	Weight	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Connector: microUSB	Screw terminals and crimp connector, max. wire section 1 mm²	Modbus Master	Relative humidity	Pollution degree: 2	Isolation double	CE standards	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
RS485	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Modbus RTU Master	Use	IP 65 on front panel (as per IEC 60529)	Isolation double	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	RTU Bridge	Altitude	On panel, removable fasciplate	Isolation category: II	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Operating temperature	Installation regulations	Pollution degree: 2	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Storage temperature	IP 65 on front panel (as per IEC 60529)	Isolation double	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Relative humidity	On panel, removable fasciplate	Pollution degree: 2	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Use	Installation regulations	Pollution degree: 2	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Altitude	IP 65 on front panel (as per IEC 60529)	Isolation double	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC
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Modbus Master	Baudrate: 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200 b/s	Ethernet Modbus TCP e Webserver (option)	Use	IP 65 on front panel (as per IEC 60529)	Isolation double	Certifications	EMC conformity (electromagnetic compatibility)	USA, Canada	EAC

*) Programming is done with the GF...xpress configuration program.

(*) If in standard mode, if in "Simplified programmer" mode, Max. 12 programs
 (**) freely selectable in any program, if in "Simplified programmer" mode, MAX 16 steps per program, in a set order, Program 1 Step 1-10, Program 2 Step 17 - 32, and 30 on

TECHNICAL DATA

OPERATOR INTERFACE	DISPLAY	KEYPAD	INPUTS
<ul style="list-style-type: none"> Type Screen area (L x H) Lighting PV display SV display F display Unit of measurement Controller state signals Output state signals Bargraph Bargraph indicator, configurable Bargraph indicator 	<ul style="list-style-type: none"> LCD back background 37 × 68 mm Backlit with LEDs, life > 40,000 hours @ 25 °C (with brightness level back = 8) Number of digits: 4 to 7 segments, with decimal point Digit height: 17 mm Color: white Number of digits: 5 to 7 segments, with decimal point Digit height: 14 mm Color: green Number of digits: 5 to 14 segments, with decimal point Digit height: 9 mm Color: amber Selectable: °C, °F or custom 1 Color: same as PV display Number: 6 (RUN, MAN, J, REM, SP1/2) Color: amber Number: 4 (1, 2, 3, 4) Color: red Type: graphic bargraph, 11 segments Power indication: 0...100% 0...100...100% Current indication: 0...100% f.s. Valve position indication: 0...100% Type: double bar, 11 segments Indication of process variable and setpoint: 0...100% f.s. Keys number: 4, silicone (Mer/Auto, INC, DEG, F) Type: mechanical 	<ul style="list-style-type: none"> Thermocouples: RTD (PT100, IPT100), IR pyrometers with type K output, 4...20mA, 0...10V, 5V, 1V, 60mV, potentiometer Reading accuracy: ±0.1% of value read The Caltra controller, when subjected to the necessary calibration operations in the field, is suitable for use in hazardous applications for any class of oven, from 1 to 6, according to specification AMS750E, paragraph 3.3.1. Types: J, K, R, S, T, C, D, E, L, L-GOST, U, G, N, Pt200h; Pt100h; Custom Invariation available Linearisation accuracy according to standard ICS90 polynomials; refer to user manual for details Cool junction accuracy: < ± 1 °C @ 25 °C room temperature Cool junction compensation: greater than 40 °C rejection at changes in room temperature exceeding 25 °C Diagnoses: indication of faulty probe and out of scale 	<ul style="list-style-type: none"> Types: PT100, IPT100, Custom linearisation available Calibration accuracy: ±0.1% of the value read in °C ± 0.4 °C Linearisation accuracy: < ±0.002 °C Thermal shift: < ±0.002% of read value/°C, starting from 25 °C (room temperature) ± 0.1 °C Diagnoses: indication of faulty probe and out of scale Types: 0...60 mV, 0...20mA, 4...20mA, 0...1V, 0...5V, 0...10V, 0...2.4V high impedance, 0...1.2V high impedance Input impedance: 0...60mV, 0...1V, 0...1.2V, 0...2.4V, > 100 MΩ 0...5V, 0...10V, > 400 Ω 0...20mA, 4...20mA, 50 Ω Linearisation: linear or custom Calibration accuracy: < 0.1% full scale Thermal shift: < ±0.003% full scale/°C, starting from 25 °C room temperature 60 ms or 120 ms, selectable 0.0...20.0 s, configurable Rejection at differential mode: > 80 dB Rejection at common mode: > 150 dB Grab C / F, selectable on the keypad Type: linear Scale: 1989, 9908, settable decimal point Functional insulation between main and auxiliary inputs Type Isolated via external transformer Number: 2 max Max. capacity: 7.50 mA-AC Line frequency: 50/60 Hz Input impedance: 10 Ω Input impedance: 10 Ω ±2%, 1 s, ±1 digit @ 25 °C 5 max Voltage-free contact, or NPN 24 V - 4.5 mA 0 PNP 12/24 V - max 3.6 mA For detail see electrical connections 250V