Power controllers with digital communications

TU2170 Series

Two-phase control of three-phase loads

Currents from 315A to 500A nominal

Installation manual

SCOPE OF MANUALS

- This Manual (ref. HA175507 ENG) is intended for:
  Installation
  Wiring and
  Configuration
  of TU2170 controllers from 315A to 500A nominal

- The TU2170 User Manual (ref. HA173939) is intended for:
  Operation
  Commissioning
  Alarms
  Communications with Eurotherm, Modbus®, Jbus® protocols
  Maintenance and
  Diagnostics

- The TU range digital communications Manual (ref. HA173535ENG) describes digital communications with Eurotherm, Modbus® and Jbus® protocols

- TU series, Profibus DP (ref. HA175215ENG) is intended for digital communications in Profibus DP protocol.

TU2170/500A

INSTALLATION MANUAL

CONTENTS

EUROPEAN DIRECTIVES

CE MARKING AND SAFETY

TU2170 products carry the CE mark in compliance with the essential requirements of the European Low Voltage Directive 73/23/EC of 19/2/73 (amended by the Directive 93/68/EC of 22/7/93).

For safety reasons, TU2170 products installed and used in compliance with this Manual meet the essential requirements of the European Low Voltage Directive.

ELECTROMAGNETIC COMPATIBILITY (EMC)

For an industrial environment only, must not be used in domestic environments

Eurotherm certifies that TU2170 products, installed and used in compliance with this Manual, meet the following EMC test standards and enable the system which incorporates them to comply with the EMC Directive, as far as the TU2170 products are concerned.

EMC test standards

Immunity	Generic standard	:	EN 50082-2
	Test standards	:	EN 61000-4-2, EN 61000-4-4, ENV 50140, ENV 50141
Emission	Generic standard	:	EN 50081-2
	Test standard	:	EN 55011
	Product standard	:	IEC 1800-3

EMC Guide

In order to help you reduce the effects of electromagnetic interference depending on the product installation, Eurotherm can supply you with the '**Electromagnetic Compatibility' Installation Guide** (ref: HA025464).

This guide lists the rules generally applicable for EMC.

DECLARATION OF CE CONFORMITY

Availability

A declaration of CE conformity is available on request.

Validation by Competent Body

Eurotherm has validated the compliance of TU2170 products with the European Low Voltage Directive and EMC test standards through product design and laboratory testing.

The tests carried out on TU2170 products are listed in a Technical Construction File validated by the LCIE (Central Laboratory for the Electrical Industries), a Recognised Competent Body.

Further information

For any further information, or if in doubt, please contact Eurotherm Controls where qualified staff are available to advise or assist you with the commissioning of your installation.

PRECAUTIONS

Safety symbols

Important safety precautions and special information are indicated in the text of the manual by two symbols:

DANGER

This symbol means that failure to take note of the information given in this manual may have serious consequences for the safety of personnel and may even result in electrocution.

ATTENTION

This symbol means that failure to take note of the information may

- have serious consequences for the installation or
- lead to the incorrect operation of the power unit

These symbols must be observed for particular points.
However the whole of the manual remains applicable.

Personnel

The installation, configuration, commissioning and maintenance of the power unit should only be carried out by personnel qualified and trained to work with low voltage electrical equipment in an industrial environment.

Independent alarm

Given the value of the equipment controlled by TU2170 products it is the responsibility of the user, and it is highly recommended, that an independent safety device (alarm) should be installed. This alarm must be tested regularly.

Eurotherm can supply suitable equipment.

Chapter 1 IDENTIFYING THE CONTROLLERS

GENERAL INTRODUCTION TO TU2170/500A CONTROLLERS

TU2170 thyristor units are designed to control the power in resistive loads with a low temperature coefficient or short-wave infrared elements.

A controller comprises two thyristor channels controlling two phases of a three-phase load.

The current controlled is between 315A and 500A per channel, with a line-to-line voltage of up to 500V max.

The operation of TU2170 controllers is managed by digital communications which allow both remote control and monitoring, with a significant reduction in low-level wiring compared with analogue systems.

TU2170 controllers offer the following functions:

- Two control modes: load voltage squared or load power
- Two firing modes: Burst-firing (8 cycles) or Single-cycle (1 cycle)
- Voltage, current and load monitoring.

The thyristor units are controlled by digital communications with a digital or an analogue setpoint.

A green LED marked Vcc on the front facia of the unit indicates that the control electronics power supply is operating.

Two red LEDs (one on each power board) show the control signals for each channel.

An alarm system detects load failures and excessive load or current variations. Indication of fault conditions is by digital communications, by fail-safe alarm relay and by two red LEDs visible through the transparent front cover of the access door.

Current monitoring ensures that the unit will shut down if the preset current limit threshold is exceeded or in case of overcurrent.

The adjustment of partial load failure detection can be achieved automatically by the ‘PLF’ push-button located on the front facia, simultaneously for all channels, or by digital communications, or by external contacts.

The voltage calibration potentiometer (labelled ‘U’) and the channel current potentiometers (labelled ‘I_1’ and ‘I_2’) are accessible from the front facia of the controller.

The controllers are fitted with permanent fan-cooling.

MAIN SPECIFICATION POINTS

Power

Nominal current (per channel)	315A, 400A and 500A
Nominal line-to-line voltage	100Vac to 500Vac (+10%, -15%) Inhibition below 85% nominal voltage
Supply frequency	50 or 60Hz (±2Hz)
Power dissipation	1.3W (approx.) per amp and per channel
Cooling	Permanent fan-cooling by two fans
Fan	46VA consumption Supply voltage: 115V or 230V
Load	Resistive with a low temperature coefficient or short-wave infrared elements

Control

Control	• By digital communications with digital or analogue setpoint • By purely analogue signal
Analogue signal	Selectable by configuration: 0 to 5V; 1 to 5V; 0 to 10V; 2 to 10V or 0 to 20mA; 4 to 20mA
Input impedance	10kΩ for 10V input; 255Ω for current input
Enable/Inhibition	By external contacts on the microprocessor board terminal block
Thyristor firing mode	Common for all channels: Burst-firing (8 cycles) or Single-cycle (1 cycle)
Control type	Common for all channels; load voltage squared or load power
Control linearity	2%

Digital communications

Communications bus	Serial link RS485 (RS422)
Communications protocol	EUROTHERM, JBUS®, MODBUS® (transmission speed 9600 baud) or PROFIBUS DP (automatic recognition of transmission speed)

Alarms

Detection	• Excessive variations in line voltage • Thyristor short-circuit • Overcurrent • Exceeding the current limit threshold • Total load failure (TLF) of each channel • Partial load failure (PLF) of each channel
Indication	Digital communications, alarm relay and one red indicating lamp (LED) per channel.

OVERVIEW

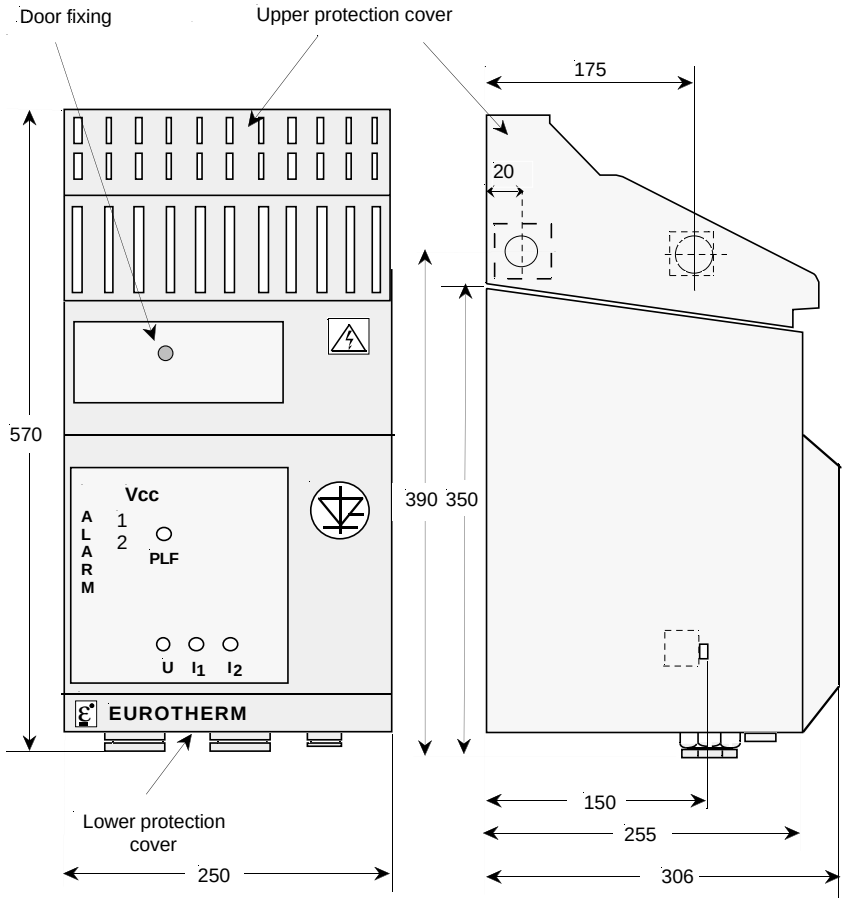


Figure 1-1 Overview and general dimensions of TU2170 controller from 315A to 500A nominal
(dotted lines: power and safety earth wiring points)

PRODUCT CODE FOR TU2170 SERIES

Model / Nominal current / Nominal voltage / Fan supply / protocol / Control type / Load type / Digital comms /

Model	Code
Thyristor controller	TU2170

Nominal current	Code
40A	40A
60A	60A
75A	75A
100A	100A
125A	125A
200A	200A
250A	250A
315A	315A
400A	400A
500A	500A

Nominal voltage	Code
100V	100V
110V	110V
120V	120V
200V	200V
220V	220V
230V	230V
240V	240V
380V	380V
400V	400V
415V	415V
440V	440V
480V	480V
500V	500V

For other voltages, please contact Eurotherm Controls

Fan supply	Code
No fan (40 to 75A)	000
115 V	115V
230 V	230V

Analogue input	Code
0 to 5 V	0V5
1 to 5 V	1V5
0 to 10 V	0V10
2 to 10 V	2V10
0 to 20mA	0mA20
4 to 20mA	4mA20

Firing mode	Code
Single-cycle (1 cycle)	FC1
Burst-firing (8 cycles)	FC8

Analogue input / Firing mode / Control inputs / Comms Alarm contact type / End 00

Control inputs	Code
Control and communications board	CCC

Load type	Code
Infrared	IR
Resistive	RES

Communications protocol	Code
EUROTHERM	EIP
MODBUS ®	MOP
JBUS ®	JBP
PROFIBUS DP	PFP

Digital comms	Code
Modbus ®, Jbus ®, & Eurotherm protocols: Without digital comms	CTRL
With digital comms at 9600 baud	96
Profibus protocol with auto recognition of transmission speed	AUTO

Control type	Code
Voltage squared	V2
Power	W

Alarm contact type	Code
Alarm relay contacts closed in alarm	NC
Alarm relay contacts open in alarm	NO

FUSES

Thyristor protection fuses

The TU2170 series power controller is delivered as standard with high-speed fuses mounted on the line bars.

DANGER!

High-speed fuses are used only for the internal protection of thyristors against large amplitude overloads.
Under no circumstances should these high-speed fuses be used to protect the installation.

The installation must be protected upstream (non high-speed fuses, thermal or electromagnetic circuit breaker, suitable fuse-isolator) and must comply with current local standards.

Table 1 lists all the original internal fuse references (as shipped from the factory) together with recommended replacement fuses for maintenance purposes.

Maximum line voltage (between phases): 500V

Nominal current		Reference		
Controller	Fuses	EUROTHERM	FERRAZ	BUSSMANN
315 A	400 A	LA172468U400	H300065	170M5458
400 A	500 A	LA172468U500	K300067	170M5460
500 A	630 A	LA172468U630	M300069	170M5462

Table 1-1 Recommended high-speed fuses for thyristor protection

Attention!

The use of any fuses other than those recommended for thyristor protection will invalidate the controller's guarantee.

Chapter 2 INSTALLATION

INSTALLATION SAFETY

DANGER!

TU2170 units must be installed by personnel qualified and trained to work with low voltage electrical equipment in an industrial environment.

Units must be installed in electrical cabinets correctly fan-cooled to ensure that condensation and pollution are excluded.
The cabinet must be closed and bonded to the safety earth in accordance with Standards NFC 15-100, IEC 364 or current national Standards.

For installations which are fan-cooled, it is recommended that a fan-failure detection device or a thermal safety cut-out should be fitted in the cabinet.

The units must be mounted with the heatsink positioned vertically, with no obstructions above or below which could inhibit or impede airflow.

If several units are mounted in the same cabinet, they should be arranged in such a way that air expelled from one cannot be drawn into the unit located above it.

Important!

Leave a minimum gap of 30cms between two units mounted one above the other.
Leave a minimum gap of 5cms between two units placed side by side.

Attention!

The units are designed to be used at an ambient temperature less than or equal to 45°C (315A and 400A nominal) and 40°C for 500A nominal.

Excessive overheating of the controller may lead to incorrect operation of the unit. This may in turn cause damage to the components.

TU2170 controllers have permanent fan-cooling.

MOUNTING DETAILS

TU2170 controllers are designed to be panel-mounted by means of fixing points located on the back of the units.

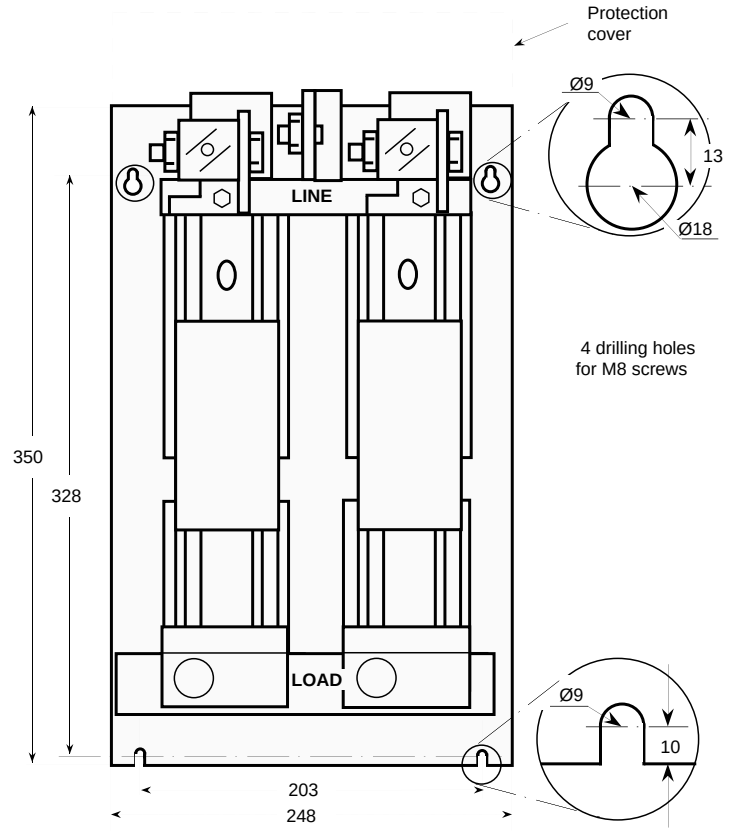


Figure 2-1 Mounting details

Having drilled the support panel to the dimensions given above, half insert the fixing screws in the bulkhead or mounting plate holes. Offer up the unit by first engaging the heads of the upper screws in the respective holes on the upper part.

Lower the unit making sure that the lower holes line up properly with the bottom screws provided. Engage the unit completely until it is in place.

Tighten the four screws correctly.

Chapter 3 WIRING

DANGER!

- Wiring must only be carried out by personnel who are qualified to work in a low voltage industrial environment.
- It is the user's responsibility to wire and protect the installation in accordance with current professional Standards.
- A suitable device ensuring electrical isolation between the equipment and the supply must be installed upstream of the unit in order to permit safe maintenance.
- Before any connection or disconnection ensure that power and control cables and leads are isolated from voltage sources.
- For safety reasons, the safety earthing cable must be connected before any other connection is made during wiring and it should be the last cable to be disconnected.

Attention!

To ensure correct grounding of TU2170 units, make sure that they are mounted on the reference ground surface (panel or bulkhead).

Failing this, it is necessary to add a ground connection at most 10cms long between the earth connection and the reference ground surface.

DANGER!

This connection, which is intended to ensure good ground continuity, can never be used to replace the safety earth connection.

EARTH WIRING

The safety earth is connected to the screw located on the bar provided for this purpose on the upper part of the unit, behind the line terminals and labelled:

The earth wire is connected to the earthing screw by means of an M12 cable lug. The earth cable gauge must be between 95 and 185mm^2.

The earthing screw must be tightened to a torque of 28.8Nm.

POWER WIRING

Power cables on the supply side pass through the opening on the upper protective cover. For connection, the upper cover, fixed to the unit, must be removed. To do this:

- Undo the front screw and open the access door by pulling it towards you
- Remove the upper cover by unscrewing its two fixing bolts - by sliding it 1cm forwards in order to free the two spigots located behind, then lifting it up.

Connection on the supply side is made on the studs of each fuse on the upper part of the unit, labelled LINE.

Power cables on the load side pass into the unit through cable glands located below the unit. Load wiring is made to the screws found in the lower part of the unit and labelled LOAD. Load cables must be terminated with cable lugs.

Details of power connections are given in the table below. Make sure you observe the tightening torques given in this table.

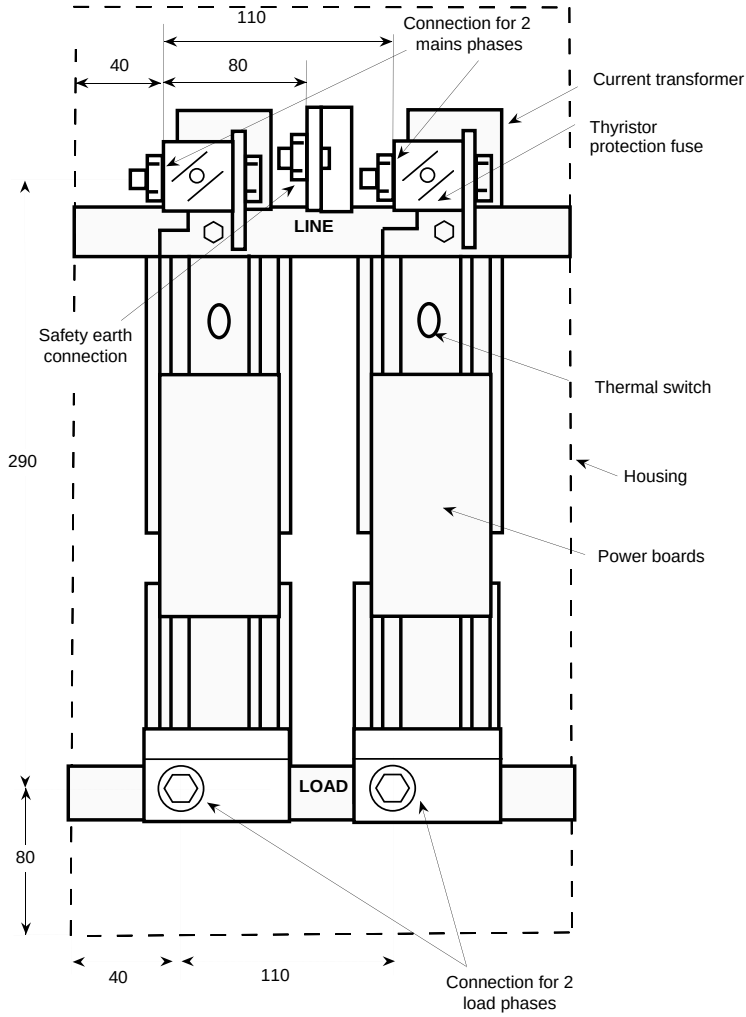
Function	Screw	Cable gauge permitted (with lugs)	Tightening torque
Fuse studs	M10	185 to 300mm^2	16.4Nm
Load screw	M12	185 to 300mm^2	28.8Nm

Table 3.0 Power wiring details

The gauge of conductors to be used must comply with Standard IEC 364.

DANGER!

Incorrect tightening can lead to incorrect operation of the controller, which can in turn have serious consequences for the installation.



Figre 3-1 Details of power wiring

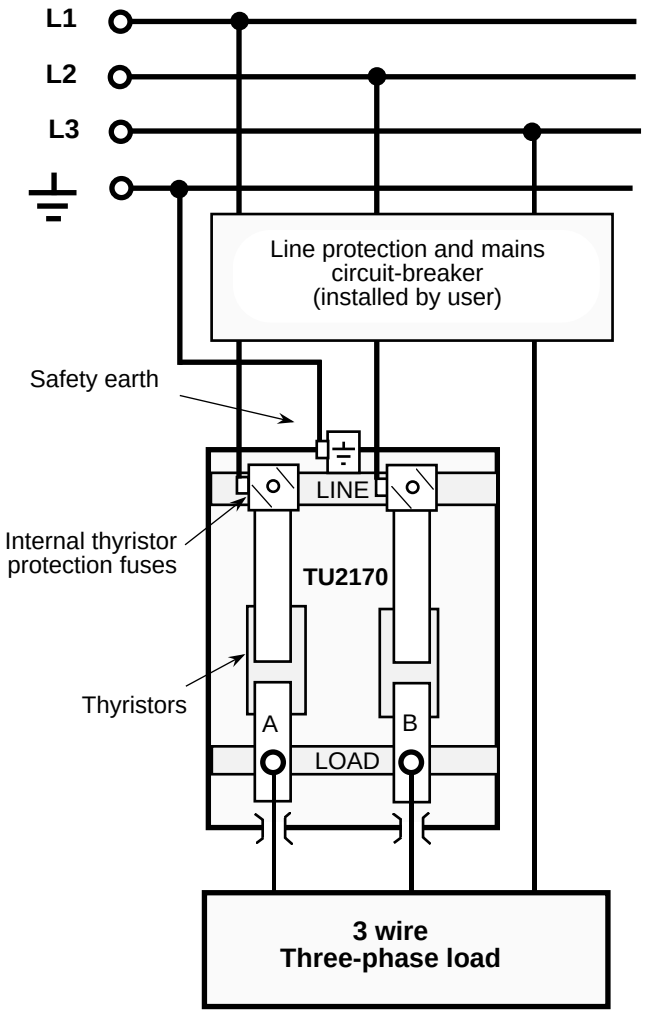


Figure 3-2 Power and safety earth connections

USER TERMINAL BLOCKS

Connections for digital communications, analogue control and enabling of the controller, are made on the microprocessor board (internal user terminal blocks).

Open the access door to reach the control terminal blocks.

All terminal blocks are plug-in.

Tightening torque for the terminals is 0.7Nm.

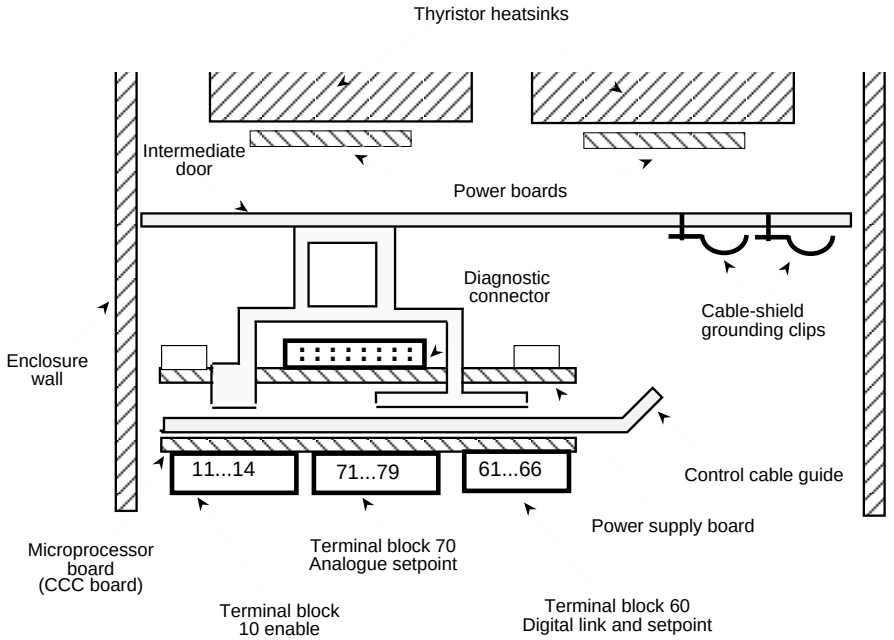


Figure 3-3 Layout of control terminal blocks (view from above)

The wire gauge is 2.5mm² max. for terminal blocks 10 and 70, and 1.5mm² for terminal block 60.

The terminal blocks used for the auxiliary power supply, the alarm relay contacts and the fan connections are located on the lower part of the controller (external user terminal blocks).

The external user terminal blocks can be reached without opening the access door.

All terminal blocks are plug-in.

Wire gauge is 2.5mm^2 max.; terminal tightening torque: 0.7Nm.

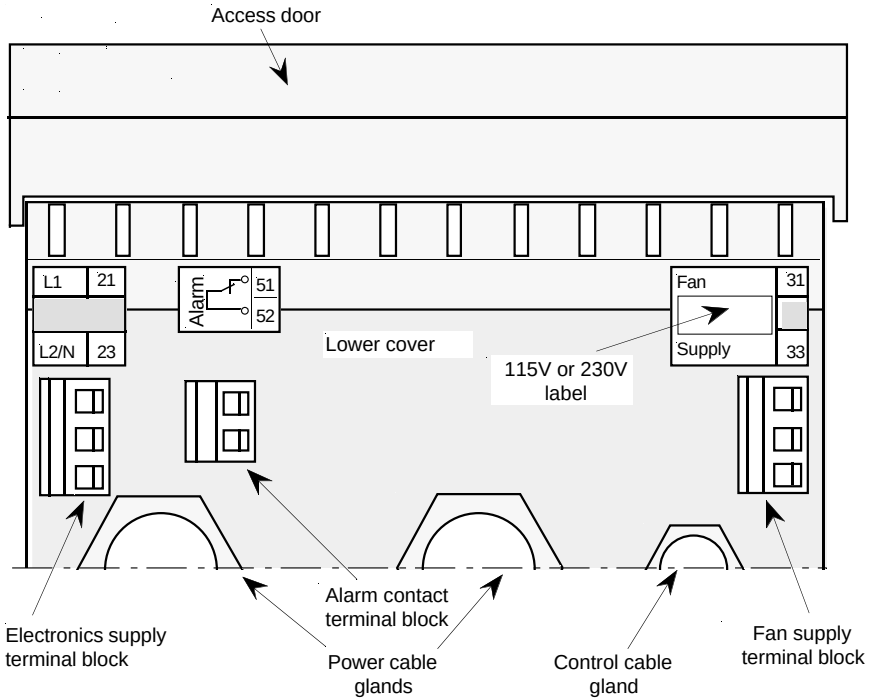


Figure 3-4 Layout of external user terminal blocks (view from below controller)

Auxiliary power supply

The auxiliary voltage provides power supply:
- for the control electronics
- for the partial load failure detection circuitry.

Terminal ‘L1’ is used to connect the first power phase.
Terminal ‘L2/N’ is used for the second supply phase.

Attention!

For correct thyristor firing, the electronics supply (terminals L1 and L2/N) and the power supply for the two channels (the terminals labelled ‘LINE’) must be in phase.

The auxiliary power supply is protected by a filter against common mode electrical interference on the supply.
Each auxiliary power supply connection wire going to a phase must be protected by a 1A fuse.

Alarm relay contacts

The alarm relay contacts, which signal the active state of certain alarms, are connected to the external user terminal block which is located below the controller (terminals 51 & 52).

The type of contact (normally open or normally closed) is configured according to the product code.

Fan supply

TU2170 315A to 500A controllers have two in-built fans.

The fan supply must be connected to the ‘Fan Supply’ terminal block (terminals 31 & 33).
The fan supply is 115Vac or 230Vac and is indicated on the label of the power supply terminal block.
The fan supply voltage is specified in the product code when ordering.

Fan consumption:
15W below 230V, 50Hz (14W, 60Hz)
15.5W below 115V, 50Hz (14.5W, 60Hz).

For fan supply protection, use a 0.5A fuse in each wire going to a phase.

CONTROL WIRING

Attention!

Control connections must be made using shielded cables grounded at both ends in order to ensure maximum immunity against interference.

Separate the control cables from the power cables in cable trays.

The control wires must be grouped together in shielded cables passing through the cable guide (mounted on the CCC board) and through the cable clamps mounted on the intermediate door.

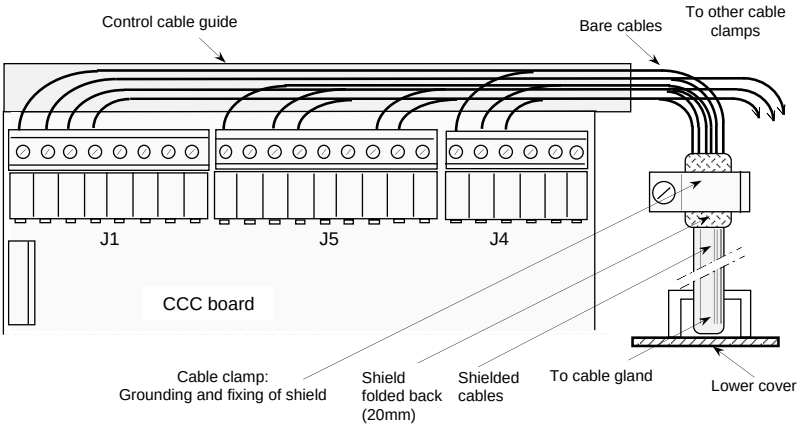


Figure 3-5 Control wiring connections

To facilitate the earthing of the cable shield and to ensure maximum immunity from electro-magnetic interference, the metal cable clamps are bonded directly to the ground.

Plug-in connectors on the control terminal blocks are designed for cables:
from 0.5 to 2.5mm^2 on terminal blocks 10 & 70 and
from 0.5 to 1.5mm^2 for terminal block 60.
Wiring inside the unit should be as short as possible.

Fixing screw tightening torque: 0.7Nm.

MICROPROCESSOR BOARD (CCC BOARD)

The following three terminal blocks are located on the microprocessor board:

- Two channel enabling
- Analogue control
- Digital control.

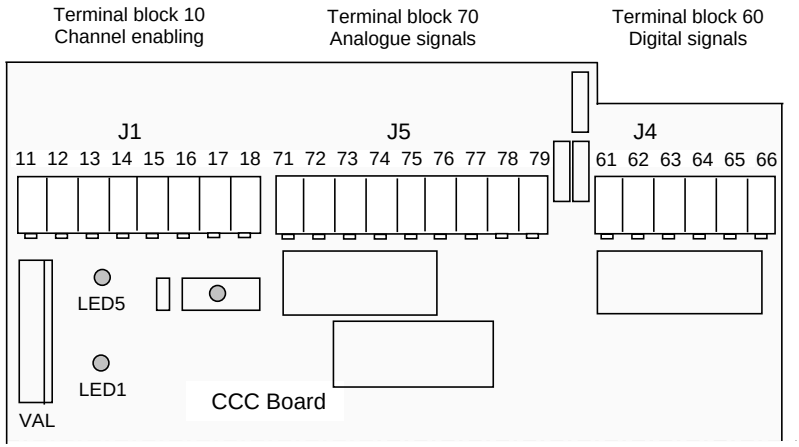


Figure 3-6 Layout of terminal blocks on CCC board

Enable terminal block

Enabling for controller operation (per channel) is done by linking corresponding terminals on terminal block 10 (‘Enable’) on the microprocessor board.

The enabling terminals for channel 1 are 11 & 12, and 13 & 14 for channel 2.

Open circuiting these terminals inhibits the channel concerned.

Enabling of a channel can be achieved by a permanent link, directly on the enable terminal block, or by external contacts.

In the latter case, the wires connecting the terminals to these contacts must be shielded. The shield should be earthed at both ends.

Control terminal blocks

Depending on the type of control signals (analogue or digital), terminal blocks 70 or 60 are used.
Terminal block 70 is for analogue signals.
Terminal block 60 is for digital signals.

If the analogue control signal is used under digital control, the two terminal blocks are used in conjunction with each other.

Terminal number	Labelling
71 & 72	0V common
73	User +10V
74	'A/N' = Choice of setpoint: analogue or digital
75	External input of PLF alarm adjustment
76	'RI1' Analogue input
77, 78 & 79	Not used

Table 3-1 Terminal labelling of analogue control terminal block

Terminal number	Labelling
61 & 62	'RX-' and 'RX+' signal receive
63	'0VT' = 0V of digital signals
64 & 65	'TX-' and 'TX+' signal transmit
66	'5VT' = +5V of digital signals

Table 3-2 Terminal labelling of digital control terminal block

Attention!

The choice between analogue and digital setpoints is made by the 'A/N' input (Analogue/Digital setpoint). To use the digital setpoint, terminal 74 ('A/N') must be connected to terminal 73 ('+10V').

Control signal wiring

Control signal wiring is effected by the plug-in terminal blocks
- 60 (digital setpoint) or
- 70 (analogue setpoint)

which can be reached with the access door open.

DANGER!

- Parts at dangerous voltages may be accessible when the access door is open if the controller is connected to the supply.
- Before opening the access door, ensure that the heatsink is not hot.

To use the digital setpoint:
Terminal 74 (‘A/N’) must be connected to terminal 73 (‘+10V’)

To use the analogue setpoint:
Terminal 74 (‘A/N’) must be disconnected from ‘+10V’.

Examples of digital and analogue signal wiring are given on the following pages.

Digital setpoint

Digital signals must be connected to terminal block 60 (6-pin connector on the microprocessor board). Terminal labelling is shown in Table 3-2 on page 3-10.

To use the digital setpoint, terminal 74 must be connected to terminal 73 (‘+10V’).

The Master for digital communications is generally a digital control/command system (SNCC on diagram) possibly with an interface unit of type EURO MI 400RTS or D241.

If a programmable logic controller is used, communications with TU2170 units can usually be directly achieved with a two-wire RS485 link.

The use of a four-wire RS422 link is possible with Modbus ®, Jbus ® and Eurotherm protocols.

The 0VT link (terminal 63) is optional.

To guarantee the operational reliability of the communications link (without data corruption due to noise or line reflections), connections must be made using shielded, twisted pairs.

The line must be fitted with a termination resistor at each end.
The resistor value depends upon the characteristic impedance of the line (R = 120Ω when Z0 = 220Ω).

For line termination and polarisation, three mini switches (SW1, SW2 & SW3) on the microprocessor board enable three internal resistors to be inserted at the end of the bus.

Attention!

If using several controllers on the same communications bus, the mini switches setting the termination resistance must only be set to the ON position for the last controller on the bus.

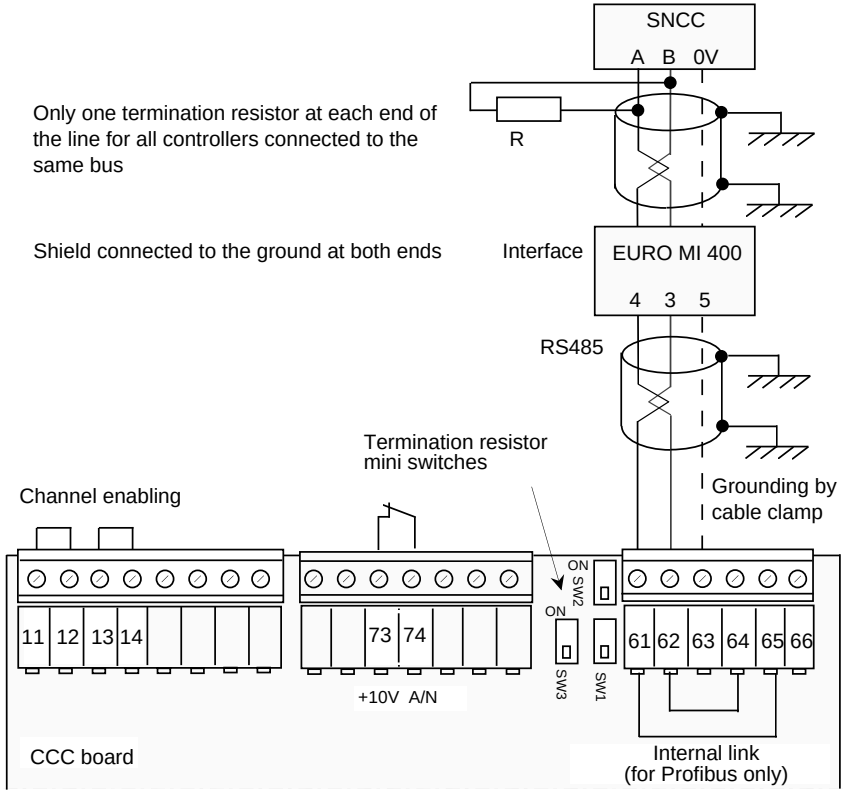


Figure 3-7 Example of digital setpoint wiring with PROFIBUS DP protocol and EURO MI 400 RTS interface. RS485 communication bus. The '0VT' link is optional.

To use the PROFIBUS DP communications protocol, a Profibus Board is added at the factory; it is mounted on the microprocessor board (CCC board).

The 'CCC Board and Profibus Board' assembly is covered by a protective panel (Figure 4-5).

Analogue setpoint

The analogue setpoint is connected to terminal block 70 between terminals 71 & 76 (‘+’).

The analogue setpoint can be used without digital communications or under digital control, in order to relay data to a control node.

Attention!

If using Profibus DP protocol, TU2170 controllers operate only with active digital communications.

To use an analogue setpoint with digital control, terminal 74 (‘A/N’) must be disconnected from terminal 73 (‘+10V’).

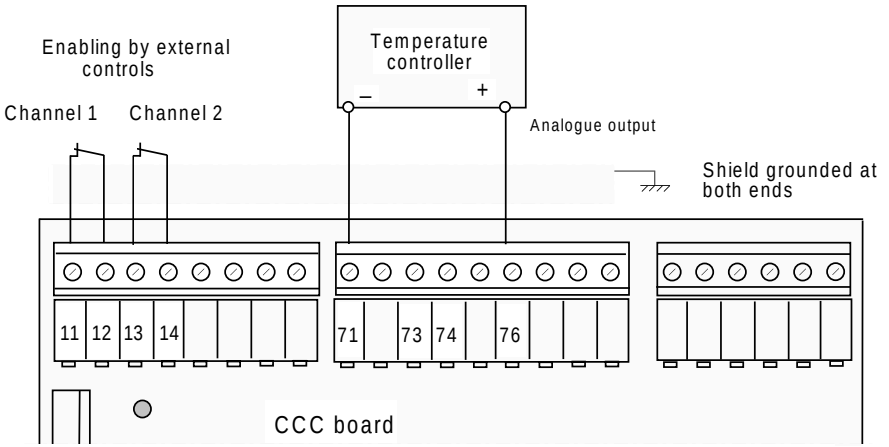


Figure 3-8 Example of analogue signal wiring without digital communications

Analogue setpoints are either the main setpoints coming from a temperature controller, or back-up (default) setpoints in case of digital communications failure.

Manual control

In the event of a digital communications failure, the back-up (default) mode allows operation of the unit under manual control.

For manual control, use a 10k potentiometer connected between terminals 73 (+10V) and 71 (0V) on the microprocessor board.

The potentiometer wiper is connected to the analogue input (terminal 76).

The default mode may employ an external 0 to 10V analogue voltage instead of the voltage provided on the user terminal block.

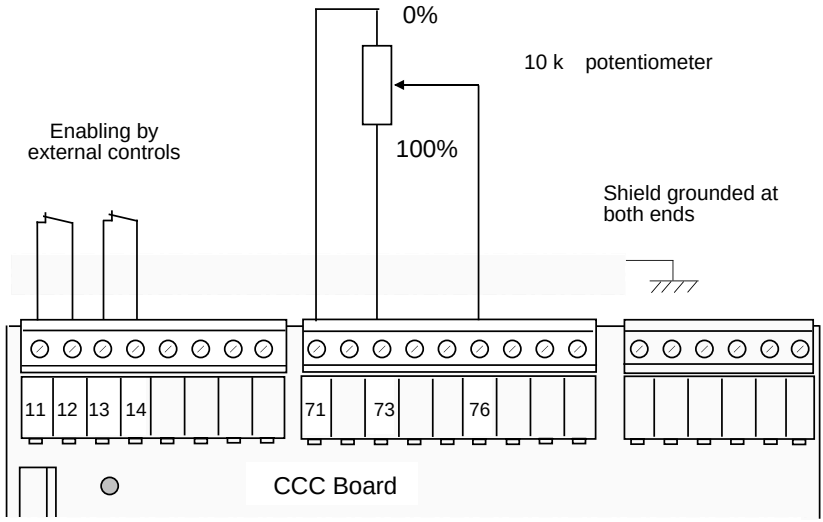


Figure 3-9 Example of manual control wiring in case of digital communications failure

When using manual control, terminal 74 (‘A/N’) must be disconnected from terminal 73 (+10V).

WIRING EXAMPLES

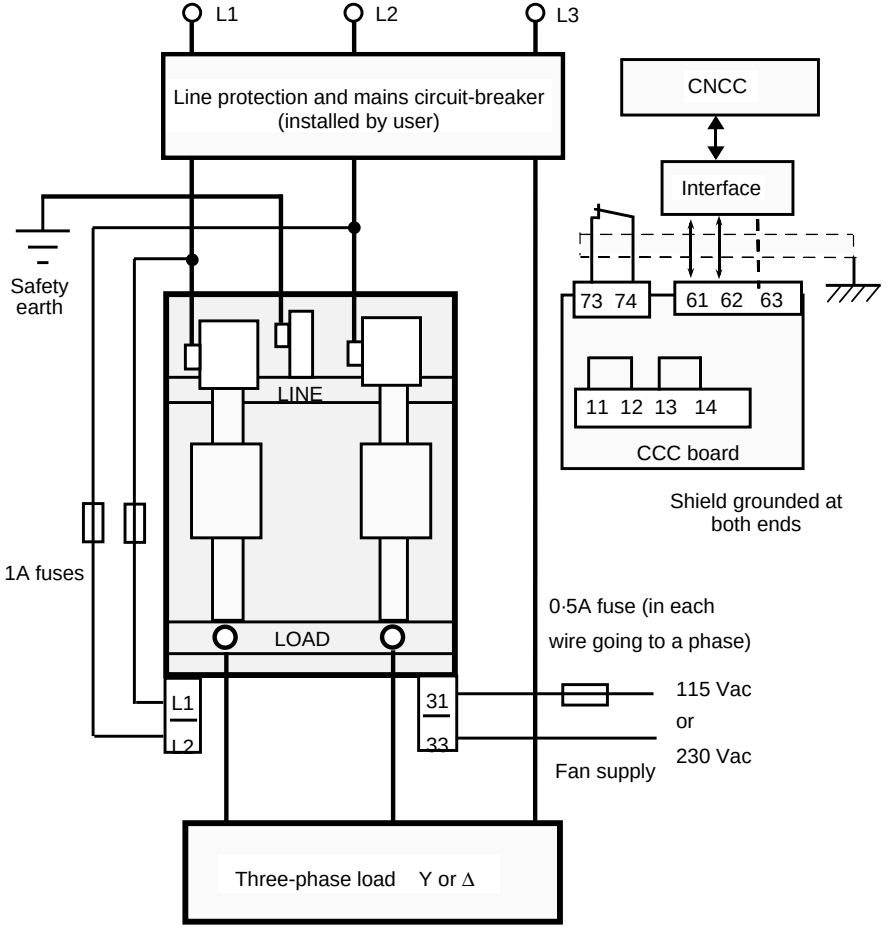


Figure 3-10 Example of manual control wiring in case of digital communications failure

Chapter 4 CONFIGURATION

CONFIGURATION SAFETY

The unit is configured by moveable jumpers, located on the supply, power and microprocessor boards.

Important!

The controller is supplied fully configured in accordance with the product code on the identification label.

This chapter is included with a view to:

- Checking that the configuration is suitable for the application, or
- Modifying, if necessary, certain characteristics of the controller on site.

DANGER!

For safety reasons, re-configuration of the controller using the jumpers must be carried out with the unit switched off and by qualified personnel.

Before starting the re-configuration procedure, ensure that the controller is isolated and that any accidental power-up is not possible.

After re-configuring the controller, amend the codes on the identification label to prevent any later maintenance problems.

POWER SUPPLY BOARD

The power supply board is used for:

- The selection of voltage for the electronics power supply
- The selection of voltage for power control
- The connection of a thermal monitoring circuit
- The selection of alarm relay contact type.

The mains supply voltage is accommodated using a transformer with two primary windings (corresponding to the operating voltage of the controller).

Five types of transformer, each at 18VA are used.
Their reference numbers and primary voltages are as follows:

CO 175080	100 and 200 V
CO 175079	115 and 230 V
CO 175081	230 and 400 V
CO 175083	230 and 440 V
CO 175082	230 and 500 V.

The electronics supply voltage is selected using jumper ST1 (see Figure 4-1) on the primary side of the power supply transformer.

The 230 V setting of jumper ST1 enables the controller fitted with any transformer (200 V for transformer ref. CO 175080) to be supplied with 220 to 240 V.

The OTHERS setting of jumper ST1 enables the controller to be supplied with 100, 115, 400, 440, 480 or 500 V depending on the type of transformer.

Selection of the voltage used for power regulation by the microprocessor board is determined using jumper ST2.

This voltage has a fixed relationship to the electronics supply voltage.

Attention!

In order to achieve correvt operation of the unit, the power and terminals must be connected between the same phases (see wiring diagram, Figure 3-10).

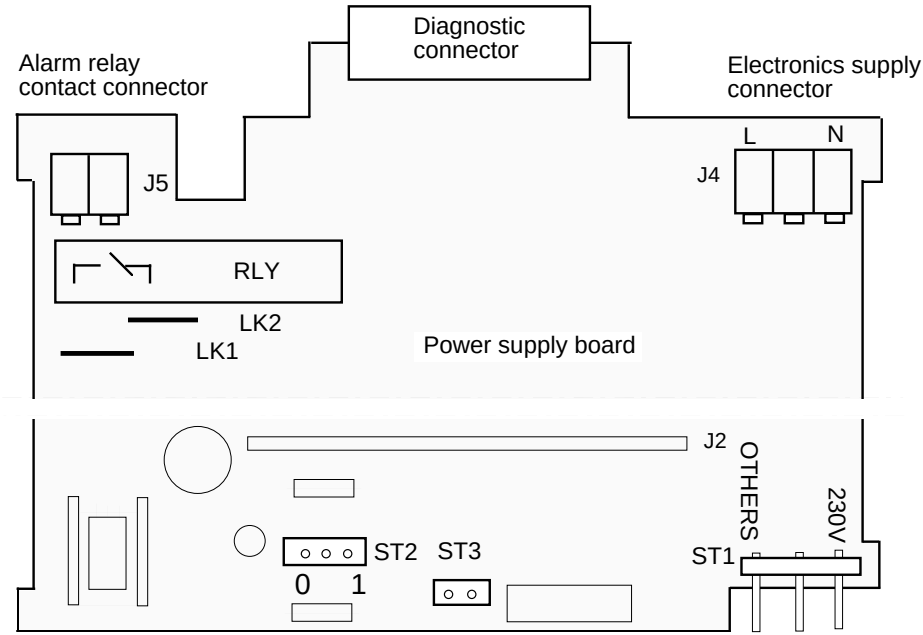


Figure 4-1 Location of jumpers on power supply board (view from component side)

Options		**Jumper settings**		
		ST1	**ST2**	**ST3**
Primary power suuply voltage	220 (240) V 110 (120) V 380 (415) V 480 (500) V	230V Others Others Others		
Control voltage			0	
Thermal safety				Short-circuit by connector

Table 4-1 Jumper settings on power supply board

Pins ST3 on the power supply board (connection of thermal monitoring circuit) for TU2170 controllers are short-circuited at the factory by a connector.

The choice of alarm relay contact type, normally closed (N/C) or normally open (N/O), is made by bridges LK1 and LK2 soldered at the factory, according to the product code. The relay contacts are available on external user terminal block 50, located below the controller.

POWER BOARDS

The power boards are used for:

- Thermal switch connections (for fan-cooled controllers)
- Selection of current and voltage data for the microprocessor

TU2170 315A to 500A controllers have permanent fan cooling by two internal fans, and over-temperature detection.

The thermal switches for these controllers are located on the thyristor heatsinks. They are connected by looms to pins THSW on the power board of each channel.

Removal of the connector short-circuiting pins ST3 on the power supply board, or opening one of the thermal switches (in case of over-temperature detection or fan failure) breaks the thyristor control circuit and leads to a total load failure alarm (TLF).

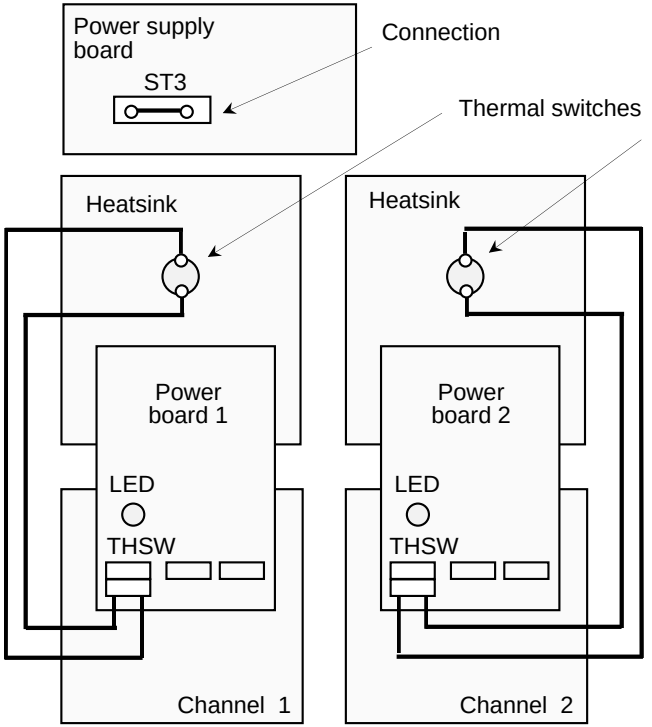


Figure 4-2 Thermal switch connections on power boards

The setting of jumpers KD1 to KD4, which select current data for the microprocessor, and jumpers KD5 to KD8, which select the thyristor firing input address, are given in Table 4-2.

Power board channel	Jumpers			
	KD1 & KD5	KD2 & KD6	KD3 & KD7	KD4 & KD8
1	Present	Absent	Absent	Absent
2	Absent	Present	Absent	Absent

Table 4-2 Setting of KD jumpers on power boards

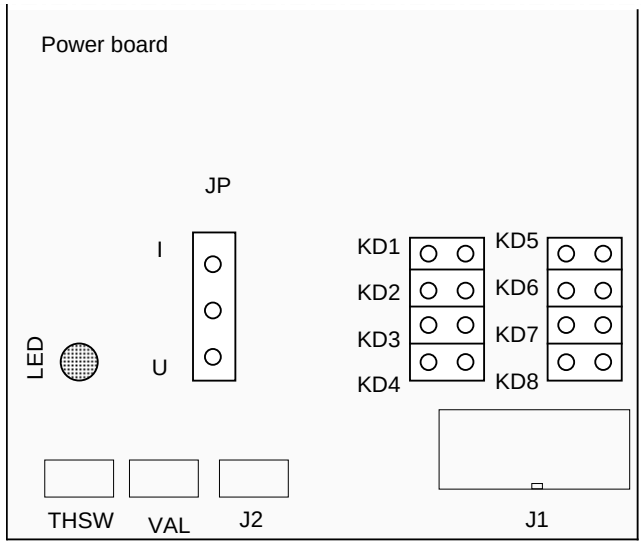


Figure 4-3 Location of jumpers on one of the power boards

Jumper JP must always be in the U position.

MICROPROCESSOR BOARD

Configuration of the controller according to the product code and any possible re-configuration are carried out by jumpers located on the microprocessor board.

To reach these, remove the access door.

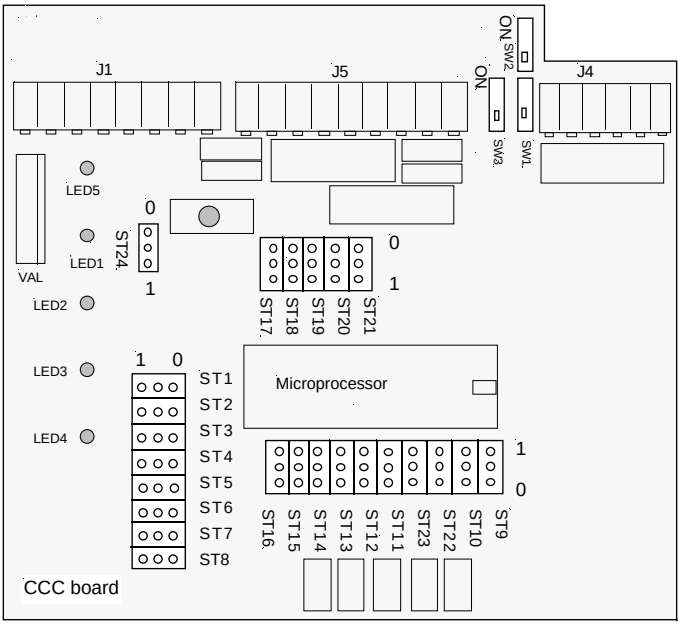


Figure 4-4 Location of jumpers on microprocessor board

Jumper ST24 is always set to 1.

Jumper ST9 determines the use of digital communications.
To use with digital communications, jumper ST9 must always be set to 1.
Jumper ST9 should be in the 0 setting for use without digital communications.

Attention!

For Profibus protocol, jumper ST9 must always be set to 1

To use the PROFIBUS DP communications protocol, a Profibus Board is added at the factory; it is mounted on the CCC board.

The whole ‘CCC Board and Profibus Board’ assembly is covered by a protective panel (Figure 4-5).

On this panel, the digital communications connection terminals 61 & 65 are labelled B, and terminals 62 & 64 are labelled A.

The openings in the protective panel and the labelling of terminals and jumpers on this panel permit connection of digital signals, and configuration of the CCC board through the protective panel.

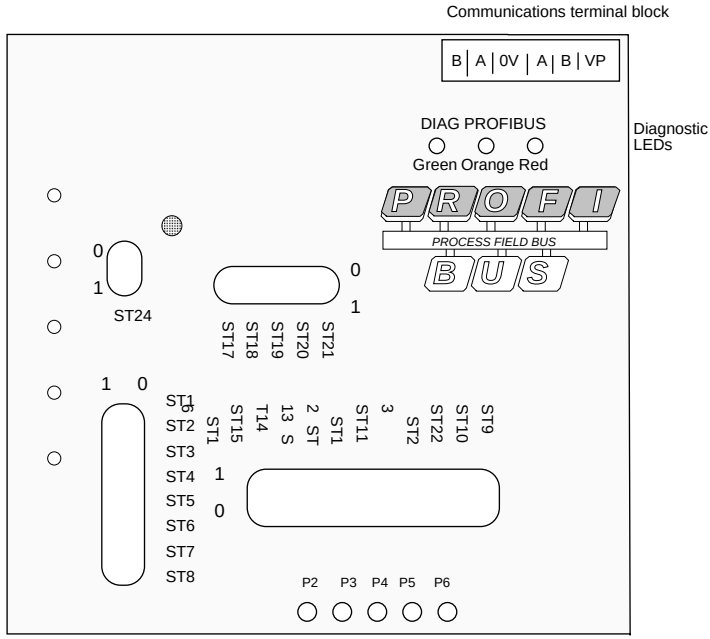


Figure 4-5 Protective panel for ‘CCC Board and Profibus Board’ assembly

Three diagnostic LEDs located on the Profibus board and visible through the protective panel indicate the communications state.
If the green and orange LEDs are on and the red LED is off: exchange of data on the bus.
If the red and orange LEDs are off: power supply failure or operating error.
If the red LED is on and the orange LED is off: serious error, communications halted.
For complete diagnostic information, see ‘Profibus DP Protocol’ Manual ref: HA 175215ENG.

Configuration with digital communications (ST9 = 1)

Configured parameter		Jumper settings							
		ST1 to ST4	ST5 to ST8	ST19	ST18	ST11 to ST16 ST22 ST23	ST17	ST20	ST21
Analogue input voltage (dc)	0 to 5 V	0	1	0					
	1 to 5V	0	1	1					
	0 to 10V	0	0	0					
	2 to 10V	0	0	1					
Analogue input current (dc)	0 to 20mA	1	1	0					
	4 to 20mA	1	1	1					
Thyristor firing mode		Single-cycle (1 cycle)			0				
		Burst-firing (8 cycles)			1				
Controller address						see p 4-9			
Control parameter		Voltage squared					0		
		Power					1		
Load type (for PFL detection)		Resistive						0	
		Short-wave infrared elements						1	
Microprocessor protocol		PROFIBUS DP and EUROTHERM							0
		MODBUS ®							0
		JBUS ®							1

Table 4-3 Configuration of jumpers on the microprocessor board
Use with digital communications

Jumper ST24 must be set to 1.
Jumper ST10 must be set to 0.

Address configuration

The address of each thyristor unit must be configured by setting jumpers ST11 through ST16, ST22 & ST23. The unit address is that of channel 1.

The channel addresses of the same controller are consecutive, and are numbered 1 to 255.

Jumper settings ST11 through ST16, ST22 & ST23 are related to the controller address expressed in 8-bit binary.

Example: The address of the controller is 92.

92 in 8-bit binary is:

Bit 7→ 0 1 0 1 1 1 0 0 ← Bit 0

The corresponding configuration of jumpers on the microprocessor board is given in the figure below.

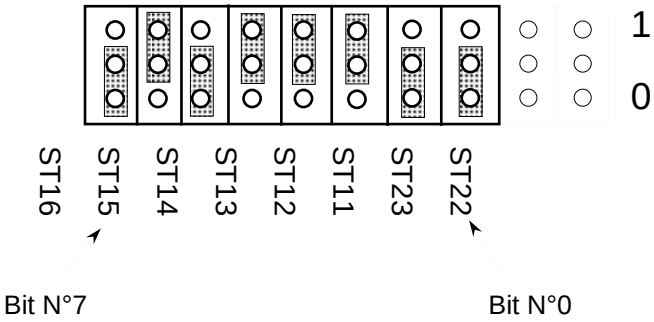


Figure 4-6 Example of address jumper configuration

Address 00 is the broadcast address and shall not be set on the jumpers as it is a special address which allows a common message to be sent to all the controllers connected to the same communications bus.

See Digital Communications Manual for the TU range.

- Ref. HA 173535ENG for Eurotherm, Modbus & Jbus protocols
- Ref. HA 175215ENG for Profibus DP protocol.

Communications protocol

There are three microprocessor references:

- Microprocessor programmed with the EUROTHERM protocol
- Microprocessor programmed with the MODBUS ® and Jbus ® protocols
- Microprocessor programmed with the PROFIBUS DP protocol

Protocol selection is set by jumper ST21 (see Table 4-3).

The protocol programmed into the microprocessor is determined when ordering.

A label on the microprocessor (Figure 4-7) identifies the protocol type.

The following codes are used on this label:

PFP:	PROFIBUS DP protocol
EIP:	EUROTHERM protocol
MOP/JBP:	MODBUS ® and JBUS ® protocols.

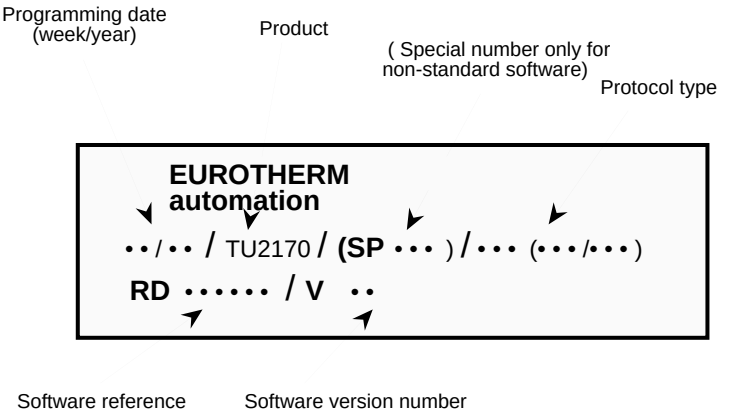


Figure 4-7 Microprocessor label

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