

TAYLOR STUDWELDING SYSTEMS LIMITED.



OPERATING GUIDE

FOR

CD-MULTIGUN

COMPACT CAPACITOR DISCHARGE
STUDWELDING EQUIPMENT



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A TAYLORMADE CAPACITOR DISCHARGE PRODUCT

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GENERAL INFORMATION

MANUFACTURERS DETAILS

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PURPOSE AND CONTENT OF THIS MANUAL

This manual has been written for :

- The operator of the welding machine.
- The personnel of the final customer responsible for the installation and operation of the machine.

This manual contains information on :

- Installation and connection.
- Operation.
- Technical data.
- Spare parts.
- Accessories.

GENERAL INFORMATION

FURTHER INFORMATION

Should you require additional technical information, please contact us directly (details on page 3) or our local agent / distributor (details of agents etc. can be obtained from us).

This manual contains important information which is a pre-requisite for safe operation of the equipment. The operating personnel must be able to consult this manual. In the interests of safety, make this manual available to your personnel in good time.

If the equipment is sold / passed on, please hand over this manual to the new owner. Please immediately inform us of the name and address of the new owner, in case we need to contact him regarding the safety of the device.



Please read this manual carefully before installation of the machine.



Please especially observe the safety instructions.



Do not use this welding power source for pipe thawing.



This equipment has been tested and approved in accordance with BS EN 60974-1



This equipment has been EMC tested and approved in accordance with BS EN 60974-10 (Category 2).

INTRODUCTION

INTRODUCTION

The complete range of Taylor Studwelding Systems Capacitor Discharge units are compact, portable Stud Welding equipment. The units are specifically designed to enable a small diameter range of ferrous and non-ferrous weld studs to be welded to light gauge, self-finish or pre-coated materials, in most cases with little or no reverse marking.

The equipment consists of a control unit, a welding pistol and the necessary interconnecting cables and accessories (see page 6 for the equipment schedule).

THE PROCESS

Capacitor Discharge stud welding is a form of welding in which the energy required for the welding process is derived from a bank of charged capacitors. This stored energy is discharged across the gap between the two surfaces to be welded as they are propelled towards each other. The arc produced heats the two surfaces, melting a thin film of metal on each surface and the propelling force closes the gap between the two faces, thus forming a weld.

In contact welding the stud to be welded is forced by spring pressure against the work piece. At this point the arc gap between the two components is maintained by a small pip on the welding face of the stud. On initiation of the high current pulse from the capacitors, this pip vaporises and an arc is drawn between the work piece and the stud. The heat from this arc melts the base of the stud and the area of the work piece directly beneath the stud, whilst the spring pressure from the pistol accelerates the stud towards the work piece. Within 3-4 milliseconds the stud hits the work piece and the arc is extinguished. The kinetic energy contained in the moving stud and the remaining spring pressure, forge the molten parts together to form a weld.

Lift Gap welding uses a softer spring than contact. This is especially helpful when welding softer materials e.g. Aluminium as the strong spring in a contact pistol can damage the pip on the stud after more than relatively brief contact. Lift Gap also uses a solenoid coil in the pistol. When the trigger is pressed the coil is energised momentarily, lifting the stud away from the work piece to a pre-determined height and releasing, allowing the stud to accelerate back towards the work piece. The high current pulse initiates on contact and the weld takes as in contact welding but at a much faster rate (1-2 milliseconds) because of the acceleration from the lift.

EQUIPMENT SCHEDULE

EQUIPMENT

No. OFF	DESCRIPTION	PART No.
1	SYSTEM CD MULTIGUN CONTROLLER	99-100-194

ACCESSORIES (NOT SUPPLIED WITH EQUIPMENT)

No. OFF	DESCRIPTION	PART No.
1-3	CHUCK KEY	79-101-111
1-3	CD CONTACT PISTOL	99-100-020
or	CD LIFT GAP PISTOL	99-100-023

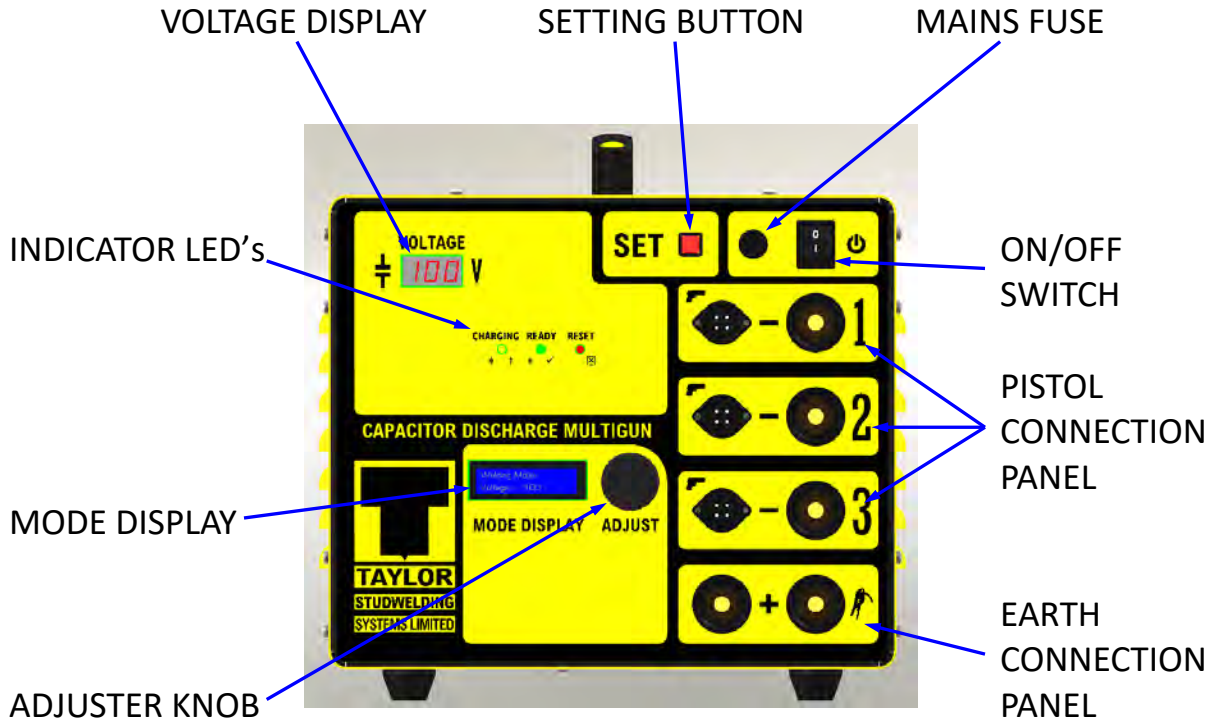
NOTE! LIFT GAP PISTOLS MUST BE USING A 2 WIRE TRIGGER WHICH WOULD REQUIRE ALL 4 PINS IN THE CONTROL PLUG TO BE CONNECTED.
DO NOT USE OLDER 1 WIRE TRIGGER PISTOLS (WHERE PIN 2 IS UN-CONNECTED) AS THIS WILL DAMAGE THE PCB IN THE CONTROLLER, CAUSING IT TO FAIL.

1	EARTH CABLE ASSEMBLY	99-100-125
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See pages 34 to 40 of this manual for a selection of accessories available from either your local stockist or the manufacturer.

EXTERIOR FEATURES

FRONT PANEL



INDICATOR LEDs

READY (GREEN)

Indicates that the capacitor bank is charged to the pre-selected Value and is ready to weld.

CHARGING (YELLOW)

Indicates that the unit is in the process of charging the capacitors to the pre-selected voltage.

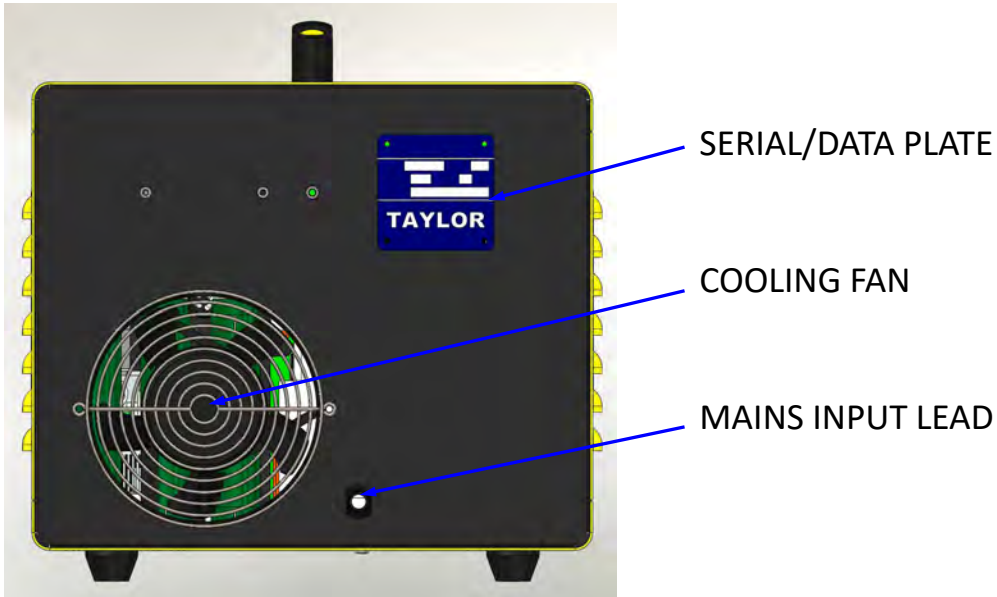
RESET (RED)

Indicates that the unit safety circuit has tripped. To reset the unit, switch off the mains switch, wait between 5 and 30 seconds then switch back on.

EXTERIOR FEATURES

REAR PANEL

ON / OFF SWITCH



IMPORTANT NOTES !



Due to the power requirements and Electromagnetic emissions produced during normal use, this machine must only be operated in an industrial environment.



This machine is set up to operate on either 115 Volts AC, or 230 Volts AC. Check the serial plate before plugging into the correct supply.



Never obstruct the ventral or rear panel ventilation holes as this may cause the unit to overheat during operation.



Never remove any portion of the unit housing without first isolating the unit from the mains electrical supply.



Servicing and maintenance must only be performed by suitably qualified personnel.

SAFETY

PROTECT YOURSELF AND OTHERS !

Read and understand these safety notices.

1. ELECTRICAL

No portion of the outer cover of the welding controller should be removed by anyone other than suitably qualified personnel and never whilst mains power is connected. ALWAYS disconnect the mains plug from the socket.



BE AWARE ! Capacitors store electrical energy. Check for residual charge before carrying out any internal maintenance.

DO NOT ! use any fluids to clean electrical components as these may penetrate into the electrical system

Installation must be according to the setting up procedure detailed on page 12 of this manual and must be in line with national, regional and local safety codes.

2. FIRE

During welding small particles of very hot metal are expelled. Ensure that no combustible materials can be ignited by these.

3. LIMITATIONS OF USE

The mass of the welding controller is between 16 and 18.5kg dependant on the model purchased and as such is suitable to be manhandled. The controller is not suitable for use in rain or snow or in an environment with increased risk of electric shock.

SAFETY

4. PERSONNEL SAFETY

Arc rays can burn your eyes and skin and noise can damage your hearing.

Operators and personnel working in close proximity must wear suitable eye, ear and body protection.

Fumes and gases can seriously harm your health. Use the equipment only in a suitably ventilated area. If ventilation is inadequate, then appropriate fume extraction equipment must be used.

Hot metal spatter can cause fire and burns. Appropriate clothing must be worn.

Clothing made from, or soiled with, combustible materials must NOT be worn. Have a fire extinguisher nearby and know how to use it.

Magnetic fields from high currents can affect heart pacemakers or other electronically controlled medical devices. It is imperative that all personnel likely to come into the vicinity of any welding plant are warned of the possible risks before entering the area.

To minimise the risks of exposure to electromagnetic radiation, operators should not drape the welding cables over their shoulders or wrap them around themselves in any way whilst using the equipment. It is also recommended that operators route the welding earth return cables away from themselves and do not stand between the two earth return cables during welding.

5. MAINTENANCE

All cables must be inspected regularly to ensure that no danger exists from worn or damaged insulation or from unsound electrical connections. Special note should be made of the cables close to the pistol, where maximum wear occurs.

As well as producing inconsistent welds, worn cables can overheat or spark, giving rise to the risk of fire.

6. TRAINING

Use of the equipment must be limited to authorised personnel only who must be suitably trained and must have read and understood this manual. This manual must be made available to all operators at all times. Further copies of this manual may be purchased from the manufacturer. Measures must be taken to prevent the use of this equipment by unauthorised personnel.

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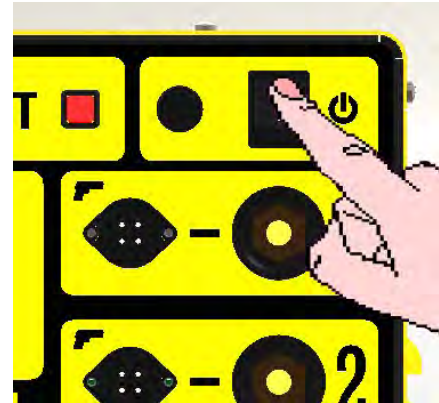
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SETTING UP & WELDING

SETTING UP & WELDING

Set up the control unit at the place of work, ensuring that the mains switch is in the OFF position. Ensure that this is done in line with the notes and safety recommendations on pages 9 through 11 of this manual.

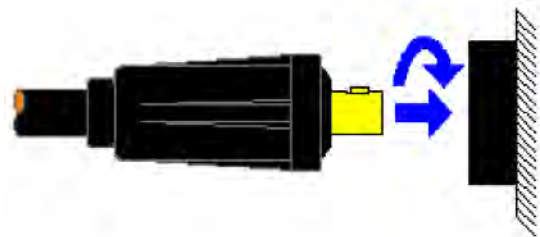


Plug the controller into the correct mains AC supply. The controller is rated for either 230V or 115V, check the rating plate and ensure that the controller is plugged into the correct supply before turning the power on.

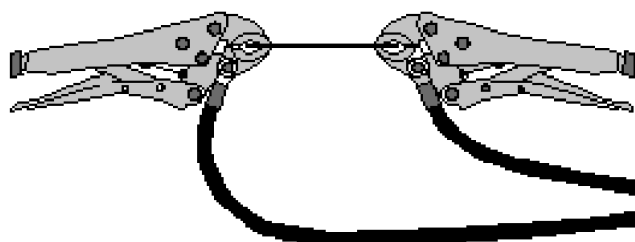


Connect the welding earth cables to the controller socket marked +. Note that the cable end plug has a peg which mates with a key slot in the panel mounted socket.

IMPORTANT ! Secure the connectors with a clockwise turn until they lock. Failure to do this will result in damage to the connectors during welding.



Attach the welding earth clamps to the work piece at approximately 180° to each other. This will help to prevent "Arc blow" when welding takes place. Prior to fitting the clamps, ensure that the contact area of the work piece is free from rust, paint, grease etc. As this will result in a poor welding connection and poor results. Where possible, route the earth cables away from the operator to prevent the operator being positioned between the run of the cables whilst operating the equipment.



SETTING UP & WELDING

Select an appropriate pistol for use with your controller. Taylor Studwelding Systems Ltd controllers are designed to operate with a range of appropriate CD welding pistols. Be sure to consult the operating guide accompanying the pistol before connection and use.



Connect the welding pistol cable to the controller socket marked -. Note that the cable end plug has a peg which mates with a key slot in the panel mounted socket.



IMPORTANT ! Secure the connector with a clockwise turn until it locks. Failure to do this will result in damage to the connector during welding.

Connect the welding pistol control cable to the controller.

Note that the cable end plug and panel mounting socket are keyed to prevent incorrect fitting. Push the plug firmly home and twist the locking ring clockwise to secure the plug in position.



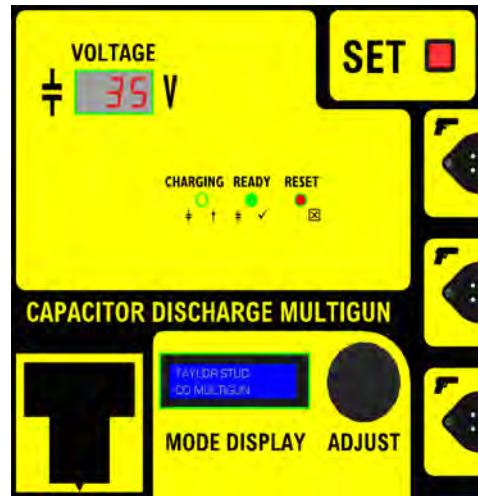
Set up the pistol in-line with the operating instructions.



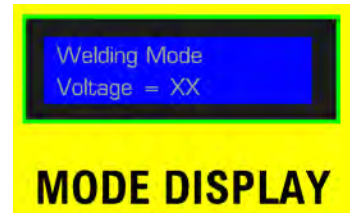
SETTING UP & WELDING

Switch the controller ON.

At switch ON the controller will briefly charge to 35V on the VOLTAGE display and the MODE display will read "TAYLOR STUD CD MULTIGUN"



Within 5 seconds the MODE display will change to "Welding Mode" and the VOLTAGE display will change to match the voltage shown in the MODE display. This is the lowest voltage that has been previously set for one of the pistols. The controller can operate up to three pistols independently. It does this by initially charging the capacitors to the lowest of the three pre-settable voltages and holding there.

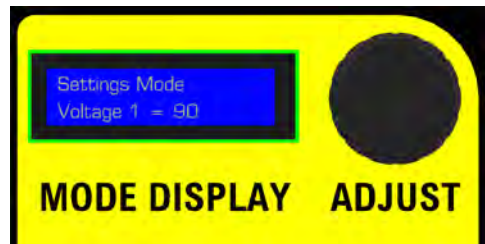


PRE-SETTING THE VOLTAGES

Press and release the "SET" button once.



The MODE display will change to read "Settings Mode Voltage 1 = XX" (where XX = the last voltage set in the memory). Turn the ADJUST knob to change the value of XX to the required setting (see the tables on pages 18 - 20 for suggested settings).



Repeat these two steps to set Voltages 2 & 3. After setting Voltage 3, press and release the "SET" button one more time. The MODE display will return to "Welding Mode Voltage = XX" (XX will now be the lowest number of the three voltages that have been pre-set above) and the VOLTAGE display will also show this value.

If you are using less than three pistols, it is a good idea to set the voltages of the unused pistol(s) to a value higher than the pistol(s) in use. This will ensure that the hold voltage at start-up is instantly available

SETTING UP & WELDING

Ensuring that a stud has been loaded, position the stud at the location on the work piece where it is to be welded. Press down firmly on the pistol until all three points of the tripod (or the face of the nose cone if using instead) are firmly in contact with the work piece. Do not drape or wrap the pistol cables over or around yourself whilst operating the equipment. Allow the cables to trail naturally to the floor.

Press the trigger.

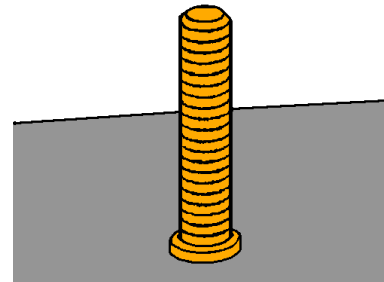
Once welding has taken place. Draw the pistol off the welded stud. Always lift the welding pistol vertically from the welded stud. Failure to do this may cause damage to the chuck, which will result in the chuck and stud arcing together during subsequent welds and thereby reducing the working life of the chuck.



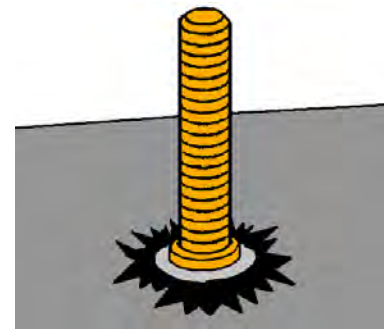
SETTING UP & WELDING

SETTING UP & WELDING

A cold stud weld is noticeable by undercutting of the flange and lack of / minimal formation of spatter. A cold weld is usually caused by too little energy and / or too high spring pressure.



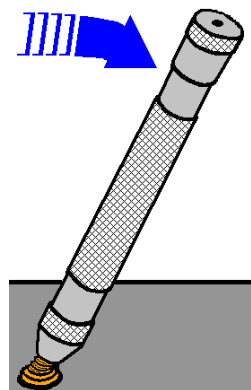
A hot stud weld is noticeable by excessive spatter formation and partial melting of the flange. A hot weld is usually by too much energy and / or too little spring pressure.



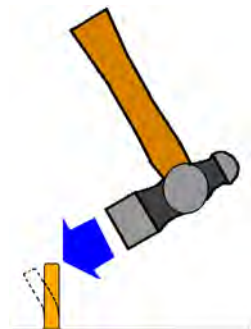
A one sided stud weld (arc blow) is usually caused by incorrect earthing of the work piece. This may be corrected by placing the welding earths opposite each other across the area where the weld is to occur.



Finished studs may be subjected to a bending test to ascertain the strength of the weld. This may be achieved by placing a bending bar assembly, fitted with the correct nozzle, over the stud and bending the stud through 30° and then back to the vertical. This test follows the specification of BS EN ISO 13918.



A simpler test may be achieved by bending the stud over 30° using a hide mallet.



WELD SETTINGS

The following pages (18 to 20) detail the suggested settings for the Multigun controller, both Contact & Lift Gap

The setting charts were established with the performance of repetitive weld tests using the standard equipment's specified above, studs manufactured to the BS EN ISO 13918 standard, in the following materials :

Mild Steel, Grade St37-3
Stainless Steel, Grade 1.4303
Aluminium Alloy, Grade AlMg3

and sheet materials of the following types :

1.6 mm Thick, Mild Steel, Grade CR4
1.6 mm Thick, Stainless Steel, Type S304
1 mm Thick, ZINTEC Coated Mild Steel, Grade CR4
1.6 mm Thick, Aluminium Alloy, Grade HE3, Half Hard

The settings are given **only as a general guide** and it is recommended that sample welds be carried out on your own material, as quality of materials and site conditions may vary from user to user.

WELD SETTINGS

CONTACT

LIFT GAP

STUD DIAMETER	STUD MATERIAL	SHEET MATERIAL	VOLTAGE SETTING	SPRING SETTING	VOLTAGE SETTING	LIFT SETTING	
M2.5	St37-3	CR4	40	2½	45	2½	
		S304	40	2½	45	2½	
		ZINTEC	60	2½	70	2	
M3	St37-3	CR4	45	2½	50	2½	
		S304	45	2½	50	2½	
		ZINTEC	75	2½	85	2	
		1.4303	CR4	45	2½	50	2½
		S304	45	2½	50	2½	
		ZINTEC	90	2½	100	2	
	AlMg3	HE3	50	3½	55	3	
M4	St37-3	CR4	60	2½	65	2½	
		S304	60	2½	65	2½	
		ZINTEC	100	2½	110	2	
		1.4303	CR4	60	2½	65	2½
		S304	60	2½	65	2½	
		ZINTEC	100	2½	110	2	
	AlMg3	HE3	65	3½	70	3	
M5	St37-3	CR4	75	2½	90	2½	
		S304	75	2½	90	2½	
		ZINTEC	110	2½	125	2	
		1.4303	CR4	85	2½	95	2½
		S304	85	2½	95	2½	
		ZINTEC	110	2½	125	2	
	AlMg3	HE3	80	3½	90	3	

WELD SETTINGS

STUD DIAMETER	STUD MATERIAL	SHEET MATERIAL	<u>CONTACT</u>		<u>LIFT GAP</u>		
			VOLTAGE SETTING	SPRING SETTING	VOLTAGE SETTING	LIFT SETTING	
M6	St37-3	CR4	90	2½	120	2½	
		S304	90	2½	120	2½	
		ZINTEC	140	2½	160	2	
	1.4303	CR4	110	2½	120	2½	
		S304	110	2½	120	2½	
		ZINTEC	140	2½	160	2	
	AlMg3	HE3	120	4	140	4	
	M8	St37-3	CR4	130	2½	175	2½
			S304	130	2½	175	2½
ZINTEC			180	2½			
1.4303		CR4	160	2½			
		S304	160	2½			
		ZINTEC	180	2½			
AlMg3		HE3	150	4	190	4	
M10		St37-3	CR4	185	2½		
			S304	200	2½		
	ZINTEC		200	2½			
EARTH TAG	St37-3	CR4	80	2½	70	2½	
		S304	80	2½	70	2½	
		ZINTEC	95	2½	85	2½	
	AlMg3	HE3	85	3½	75	3	
LARGE BRACKET	St37-3	CR4	95	2½	85	2½	
		S304	95	2½	85	2½	
		ZINTEC	110	2½	95	2½	

METHODS OF STUD LOCATION

Economic stud location may be obtained using any one of the following methods, depending on the type of work involved :-

- ❶ Tripod leg assembly.
- ❷ Nose cone assembly.
- ❸ Extended leg assembly.

❶ TRIPOD LEG ASSEMBLY.

This is generally used for low volume production and one off components. The spacing of the tripod legs allow for ease of stud placement onto a scribed or pencilled mark. Centre punch indentations must not be used.

❷ NOSE CONE ASSEMBLY.

This is generally used for high volume and repetitive work, or where a greater level of accuracy is required. Simple jigs made from Tufnol (a thermo-setting plastic) or sheet metal can easily be made, allowing for speedy and accurate production. Advice on jig manufacture can be obtained from your sales representative.

❸ EXTENDED LEG ASSEMBLY.

This is used where a requirement for welding very long studs is necessary. The extended leg assembly allows studs up to 200 mm long to be welded.

IMPORTANT NOTE !



Manual centre punch indentations must NOT be used for stud location as this will have the same effect as shortening the pip on the weld stud and could adversely affect the weld quality.

If practical considerations compel the use of indentations, then we would suggest the use of either an automatic centre punch or a punch press set only to produce the shallowest of indents consistent with the ease of stud location.

The setting chart parameters may have to be altered to achieve the optimum conditions detailed in the setting up and welding procedure.

If in any doubt, please seek the advice of your local technical representative.

WELD ASSESSMENT / TESTING

Visual examination of weld quality can, even with limited experience, provide a useful quality assessment. In such a check the presence of a small even witness of weld material around the base of the stud flange after welding should be ensured. Poor welds are indicated by excess metal on one side of the welded flange and / or the presence of an undercut or non-fused area between the stud flange and the parent sheet or plate. Incorrect settings, adverse magnetic effects etc. such as those at edge welding positions or with unbalanced earths and studs welded to the work piece at an angle, the controller and pistol should be examined with a view to correcting such defects.

MECHANICAL TESTS :

① BENDING.

The most easily applied method of testing the quality of welded fasteners considered here, involves the use of a bending bar. This bending bar (available from your supplier, see the accessories section of this manual) fitted with the correct size of nozzle for the stud to be tested is used to bend over the stud in accordance with the BS EN ISO 13918 specification .

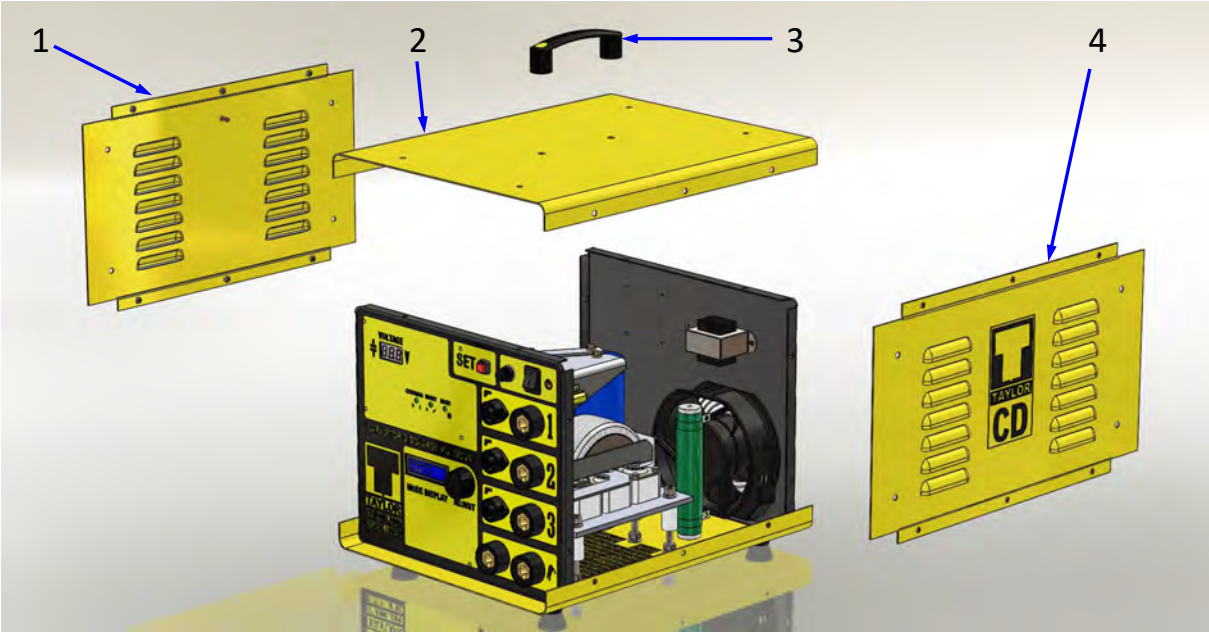
② TORSION.

A torsion test provides useful information for threaded fasteners. This involves tightening a nut on the stud against a spacer, suitably relieved to cater for the flange and weld spatter. For quantitative assessments a suitably calibrated torque wrench may be used, but at its simplest, a spanner will suffice.

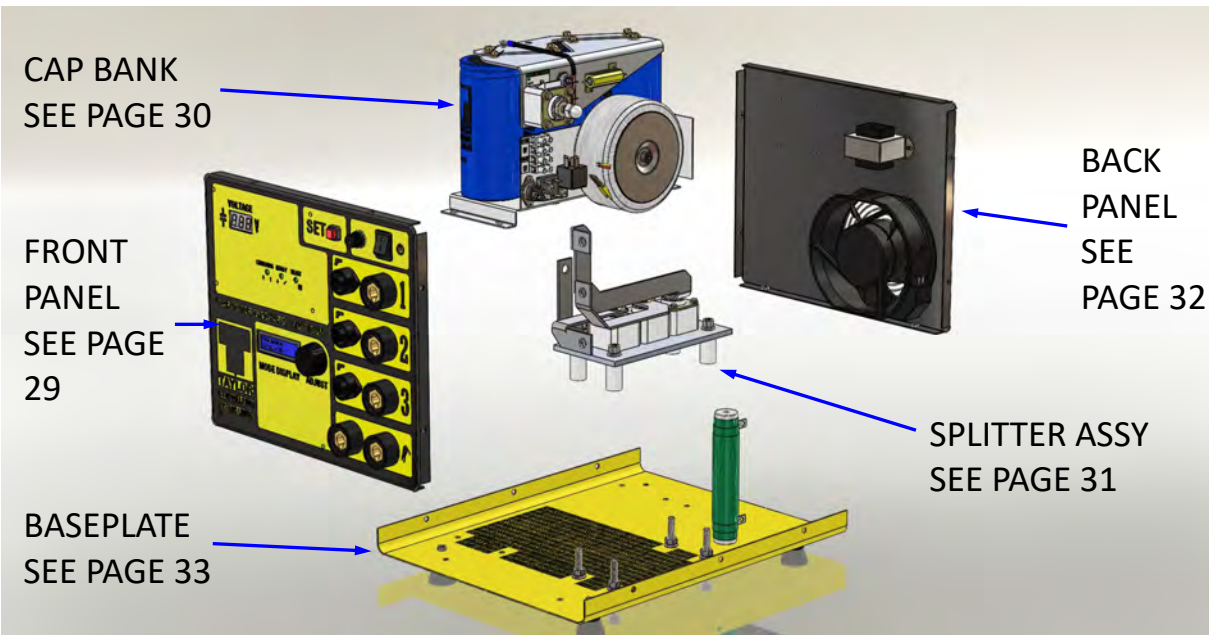
In the above tests the performance of the welded joint should be considered in relation to the thickness of the material to which the stud is welded. On thicker materials, a full strength weld is denoted by deformation or failure of the stud shank. On lighter gauge material, severe "dimpling" or "dishing" at the reverse to the weld side normally indicates sufficient strength, whilst in most cases, the tearing of a slug of material from the parent sheet will occur.

COMPONENT EXPLOSION

CD-MULTIGUN CONTROLLER

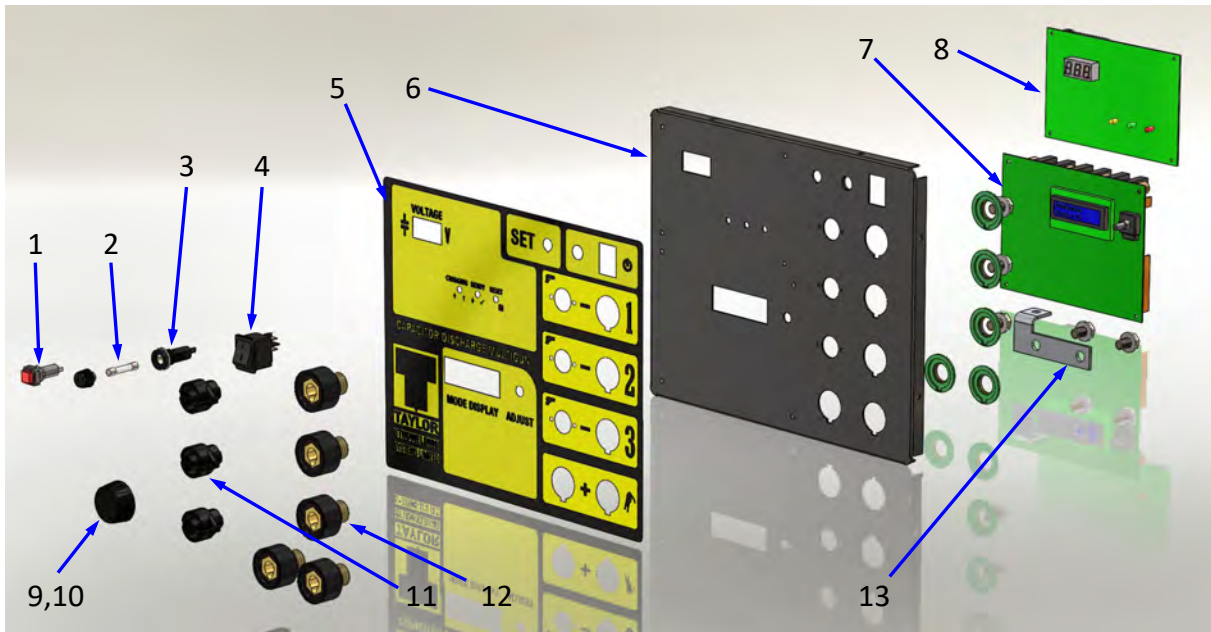


ITEM	QTY.	PART No.	DESCRIPTION
1	1	70-105-282	SIDE PANEL
2	1	70-105-281	TOP COVER
3	1	70-105-014	HANDLE
4	1	70-105-283	SIDE PANEL



COMPONENT EXPLOSION

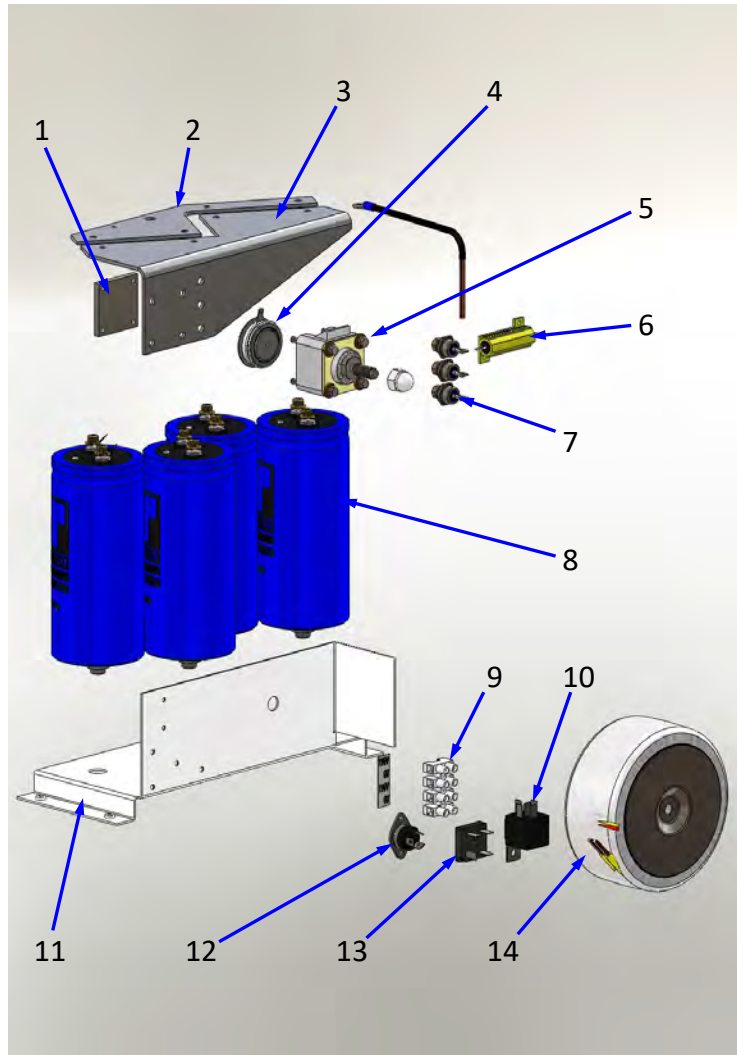
CD-MULTIGUN CONTROLLER - FRONT PANEL



ITEM	QTY.	PART No.	DESCRIPTION
1	1	81-113-010	PUSHBUTTON
2	1	70-105-125	FUSE
3	1	70-102-085	FUSEHOLDER
4	1	70-105-270	SWITCH
5	1	70-105-291	PANEL OVERLAY
6	1	70-105-284	FRONT PANEL
7	1	72-102-001	PCB
8	1	70-105-303	PCB
9	1	81-104-030	KNOB
10	1	81-104-032	KNOB CAP
11	3	70-102-025	CONTROL SOCKET
12	5	81-106-031	WELDING SOCKET
13	1	70-105-290	EARTH BUSBAR

COMPONENT EXPLOSION

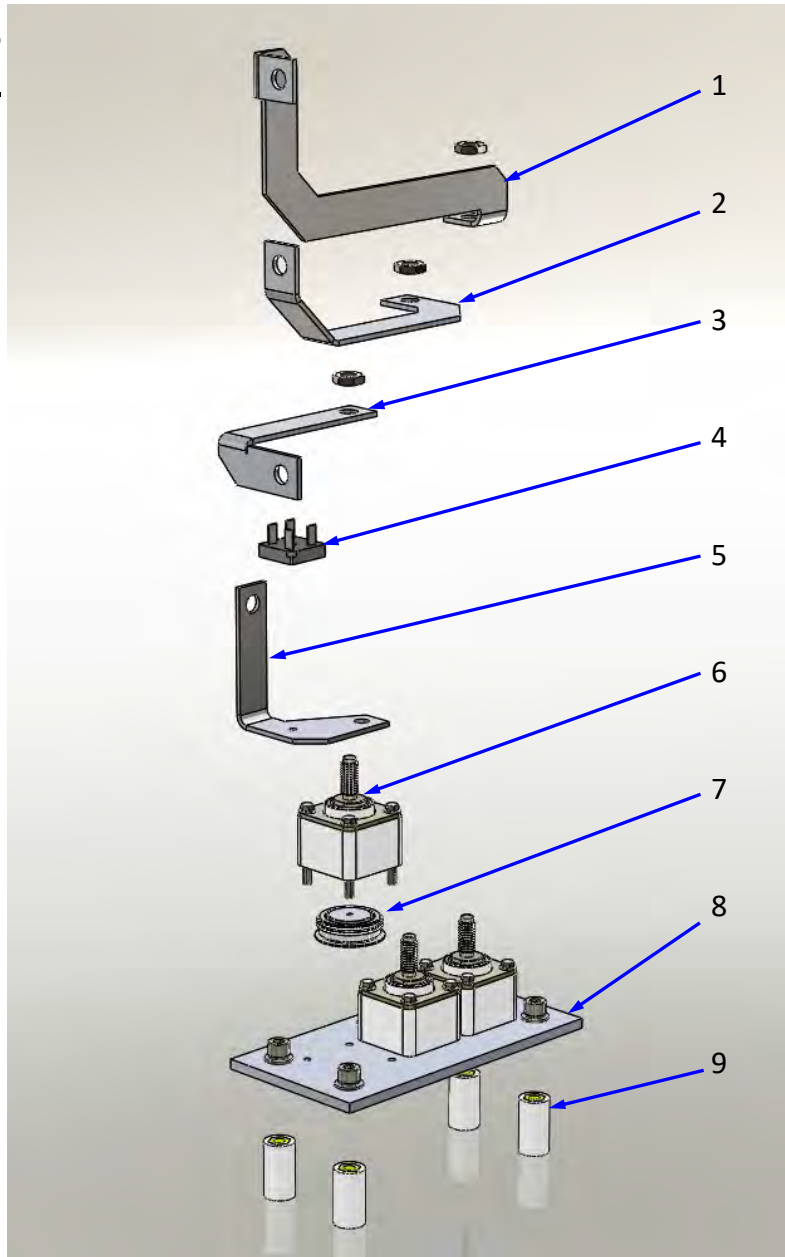
CD-MULTIGUN CONTROLLER CAPACITOR BANK ASSEMBLY



ITEM	QTY.	PART No.	DESCRIPTION
1	1	70-106-044	CLAMP PLATE
2	1	70-105-133	POSITIVE BUSBAR
3	1	70-105-134	NEGATIVE BUSBAR
4	1	70-102-046	THYRISTOR
5	1	70-102-047	THYRISTOR CLAMP
6	1	70-105-266	RESISTOR
7	3	70-102-131	DIODE
8	3	70-105-040	CAPACITOR
9	1	70-105-115	TERMINAL BLOCK
10	1	70-105-114	RELAY
11	1	70-105-131	MOUNTING BRACKET
12	1	70-102-080	TRIAC
13	1	70-102-100	RECTIFIER
14	1	70-105-113	TRANSFORMER

COMPONENT EXPLOSION

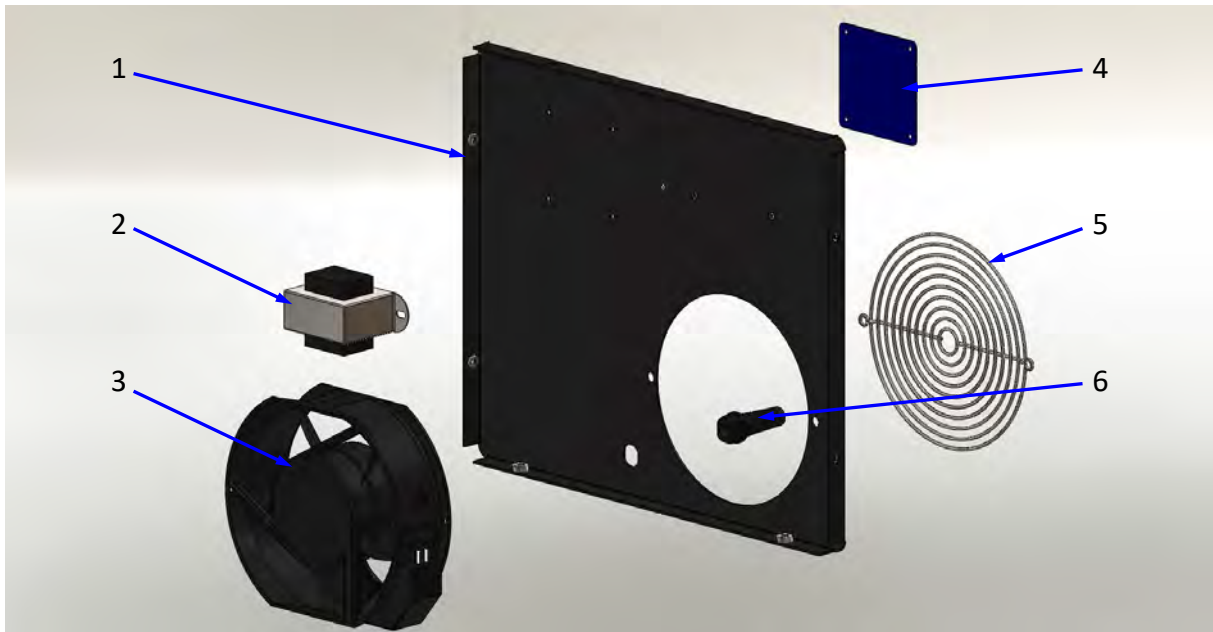
CD-MULTIGUN CONTROLLER - SPLITTER ASSEMBLY



ITEM	QTY.	PART No.	DESCRIPTION
1	1	70-105-287	BUSBAR
2	1	70-105-288	BUSBAR
3	1	70-105-289	BUSBAR
4	1	70-102-100	RECTIFIER
5	1	70-105-286	BUSBAR
6	3	70-102-047	THYRISTOR CLAMP
7	3	70-102-046	THYRISTOR
8	1	70-105-306	HEATSINK
9	4	81-113-021	MOUNTING PILLAR

COMPONENT EXPLOSION

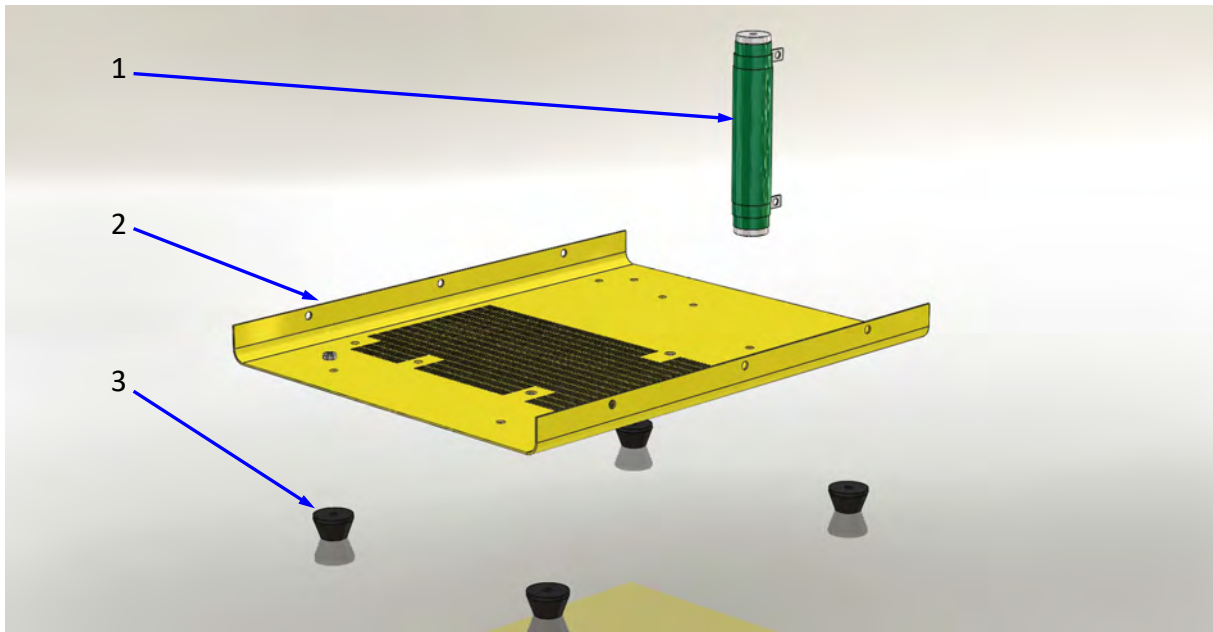
CD-MULTIGUN CONTROLLER - BACK PANEL



ITEM	QTY.	PART No.	DESCRIPTION
1	1	70-105-285	BACK PANEL
2	1	81-120-055	AUXILIARY TRANSFORMER
3	1	81-106-081	FAN
4	1	70-102-225	SERIAL/DATA LABEL
5	1	81-104-220	FAN GUARD
6	1	70-102-075	MAINS CABLE GLAND

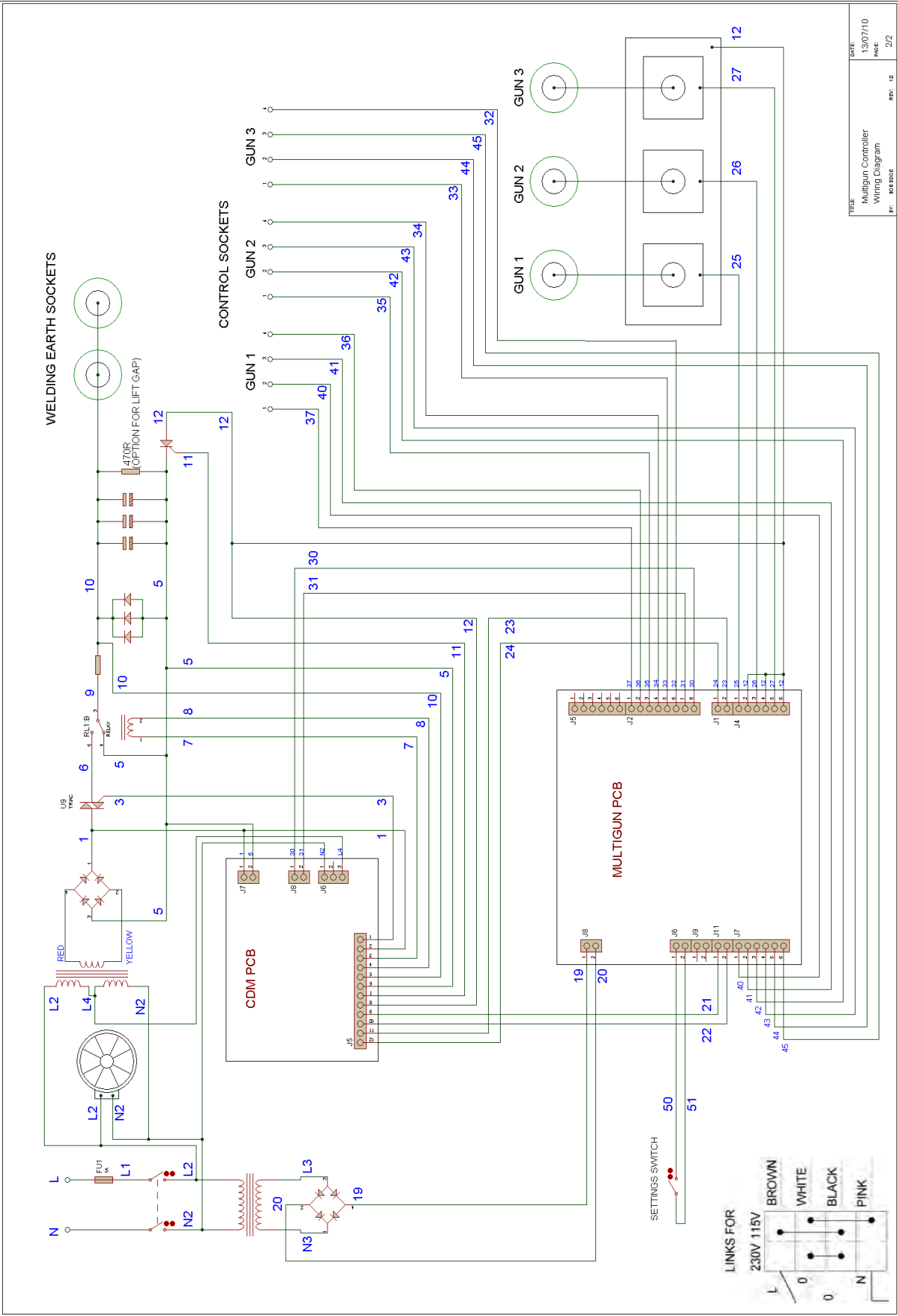
COMPONENT EXPLOSION

CD-MULTIGUN CONTROLLER - BASEPLATE



ITEM	QTY.	PART No.	DESCRIPTION
1	1	70-105-116	RESISTOR
2	1	70-105-280	BASEPLATE
3	1	81-113-024	FOOT

CIRCUIT SCHEMATIC



FILE:	Multigun Controller	DATE:	13/07/10
W:	W. B. ROSE	REV:	02
D:		REV:	02
TITLE: Multigun Controller Wiring Diagram			

EU DECLARATION OF CONFORMITY



Responsible Party Name : Taylor Studwelding Systems Ltd
Address : Commercial Road
Dewsbury
West Yorkshire
WF13 2BD
UK

Designation of Product : Studwelding equipment CDM series types CDM8, CDM9, CDM10
Studwelding gun series C1, C2, LG1, LG2

The above mentioned equipment complies with the requirements of the following directives :

93/68/EEC	The CE Marking Directive
2014/35/EU	The Low Voltage Directive
2014/30/EU	The Electromagnetic Compatibility Directive

The above mentioned products conform to the following European standards :

EN 60974-1:2012	ARC WELDING EQUIPMENT - PART 1 : WELDING POWER SOURCES
EN 60974-10:2014	ARC WELDING EQUIPMENT - PART 10 : ELECTROMAGNETIC COMPATIBILITY (EMC) REQUIREMENTS

I hereby declare that the above mentioned equipment has been designed to comply with the relevant sections of the above referenced standards. The equipment complies with all applicable essential requirements of the above mentioned directives.

Signed.

David Taylor
Managing Director



Authorised European Representative : **J D PEARMAN**
GLENN MILLERWEG 36
1311 RT ALMERE
NETHERLANDS