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RootWave Pro

Technical Manual

Model Nos. covered: PRO-001-3, PRO-002-3, TRA-001-3, TRA-002-3, APL-001-3, ETD-001-3, ETD-002-3, ETD-003-3, ETD-004-3, ETD-005-3, GRW-001-3, GRW-002-3, CAB-001-3 and CAB-002-3

English



Repair and test work must only be carried out by a qualified technician. Improper repairs or failure to test after repairs might result in death or serious injury. Read and follow all instructions and safety precautions. Keep this Technical Manual for reference - do not throw it away.



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Compliance



RootWave Pro complies with applicable EU directives:

- Low Voltage Directive (2014/35/EU)
- Electromagnetic Compatibility Directive (2014/30/EU)
- Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU
- WEEE Directive 2012/19/EU



RootWave Pro complies with applicable UK regulations:

- The Electrical Equipment (Safety) Regulations 2016
- The Electromagnetic Compatibility Regulations 2016
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- The Waste Electrical and Electronic Equipment Regulations 2013

Product improvements

RootWave's continually improves its products. This technical manual will be updated for significant improvements or any that affect safety or servicing methods. However, a technical manual update may not always follow minor improvements. If you are unsure of anything please contact your RootWave Pro supplier.

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<https://rootwave.com/servicing-report-form/>

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Introduction and purpose

This technical manual describes:

- Important safety information for repairing, servicing and testing RootWave Pro.
- Qualification level for technician to be able to competently and safely work on RootWave Pro.
- Guidance on suitable environment for working on RootWave Pro.
- Exploded view of each assembly, including order and direction of disassembly / assembly.
- Parts list.
- How to safely carry out high voltage electrical testing to check equipment before release.
- Electrical schematics.
- Special tools and consumables needed to carry out repair, servicing and test work.
- It covers both current Mk3 and previous Mk2 versions

For annual servicing procedure, refer to service guide U-SG2-PRO-001-3.

Safety information



Warning

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

To avoid risk of electric shock:

- Features in adjacent components may pose a risk to insulation and lead to electric shock. Before repair work commences, assess the surrounding area for potential hazards posed by adjacent components and plan the task to avoid those hazards. This might include sharp edges, traps, fiddly or hard to reach areas. Temporarily remove and replace adjacent components that could prevent safe access to the working area or could be over stressed or damaged during the repair.
- If not fitted correctly, connectors can separate and lead to electric shock. Ensure all connectors are fully pushed home and secure.
- Loose wires and cables can lead to excess stress on insulation and lead to electric shock. Ensure wires and cables are properly secured using the fixing locations provided.
- Wires or cables getting trapped between parts during reassembly can lead to compromise of insulation and lead to electric shock. This can occur between bosses or enclosure parts. Check that no wires or cables are trapped when parts are reassembled.

- Using incompatible parts can affect integrity and safety and might lead to electric shock. Where a Mk3 parts is specified, replace with a Mk3 part. Same for Mk2.
- Using parts of inappropriate design or quality can lead to electric shock. Only use genuine RootWave spares that have been supplied by RootWave.
- Accidental damage to insulation during repair caused by tools such as cutters used for removing zip ties can lead to electric shock. Ensure care is taken when using sharp or abrasive tools not to damage insulation. If in any doubt about whether a part has been damaged replace the part with a new one.
- Accidentally leaving parts, debris, waste or tools inside repaired equipment can lead to damage to insulation or compromise creepage and clearance distances and lead to electric shock. Thoroughly check for foreign bodies before closing enclosures.
- Fluid spills into the equipment can lead to electric shock. Keep drinks, food and any other liquids away from equipment during repairs.
- Damaged enclosures can lead to electric shock. Check integrity of enclosures and if necessary replace with new parts.
- You should not fault find with the Power Module lid removed and the system powered on and HV activated.
- Wear dielectric insulating boots.
- Ensure that screw fixings are tightened to a suitable torque. This is particularly important for those making electrical connections, for example, the HV connection in the Treatment Return.
- Repairs being completed by technicians without adequate technical training and expertise may lead to errors that result in electric shock. If you are carrying out repair tasks ensure you meet the required criteria to qualify as a Technician for these activities.
- Carrying out repairs at an inadequate workstation can lead to errors and electric shock. Repairs to be carried out in suitable workstation environment – see below.
- Once repair is complete use a electrical insulation tester to check for any indication of breakdown – see below for further instructions.
- During repairs do a visual inspection of the internals look for any signs of arcing including carbon deposits or heat damaged or melted components, cracks, any signs of damage, loose connections. Always change parts that show any of the above signs.
- If in any doubt please contact RootWave support.

Final Checks

Once any repairs are complete

1. Electrical continuity test

Complete an electrical continuity test. This is detailed in SG2.

2. High voltage electrical insulation breakdown test

An insulation breakdown test must be carried out following either:

- Repairs to high voltage components
- Repairs carried out to areas adjacent to high voltage components that could cause unintended compromise to high voltage components.

This checks the state of electrical insulation and the presence of any shorts which if undetected could be hazardous or lethal to operators.

For details of how to safely perform insulation breakdown testing see RootWave document [PRO_Work_Intruction_09](#).

Insulation breakdown tests can also be used to support annual service checks and fault diagnosis.

3. Functional check

Complete a functional check to ensure the system functions correctly after any repair work. Follow the Pro Functional Check Protocol U-FCP-PRO-001-3, which is available for download from rootwave.com/pro.

4. Labels

Once the system has been qualified, a tamper evident label can be applied to the enclosure. You should also attach a service by and date sticker.

Technician qualification

The technician should be qualified to the following levels:

- Qualified as a minimum to NVQ level 3, or an equivalent European standard, in an electrical subject, or demonstrably equivalent skills and experience. The qualification must demonstrate that they can apply technical knowledge and skills to a range of activities - including some that are complex and non-routine - and can act responsibly, with autonomy and may be able to supervise others.
- Familiar with the use of standard workshop tools such as side cutters, knives, torx and screw drivers, riveting tools, spanners, drills, torque drivers, crimping tools, multimeters and electrical insulation testers.
- Competent in workshop and electrical Health and Safety, including high voltage Alternating Current (AC) systems, able to carry out a risk assessment and define and follow safe working practices and maintain a tidy and organised environment.
- Follow instructions without taking shortcuts, will abide by warnings and cautions, will ask for help or clarification if they are unsure or if something is unclear.
- Complete all work to a high standard and inspect at key steps.
- Competent to sign off systems for release to users following repair, upgrade and servicing.
- Have successfully completed the relevant RootWave user course, can connect and disconnect the main components of the system, can use the machine in a safe manner.
- Familiar with the user guide and the health and safety information contained within it.
- Familiar with the content of the Technical Manual and is clear on the difference between high and low voltage systems and how they can be handled.
- Speaks technical English.
- The technician is responsible for their health and safety.

Workstation qualification

You are responsible for the suitability and safety of your working environment and procedures.

Guidance on suitable workstation environment as follows:

- Is clean and tidy, free from combustible material, trip hazards and debris.
- Has sufficient illumination, is quiet, is free from distraction and is well ventilated.
- Has an adequate clear, dry surface area to put the parts of the machine on.
- Lift equipment will be required to move the Power Module which is >100kg.

- A generator and a long power cable are available - a long power cable allows the generator to be placed at a sufficient distance from the Power Module so that the safety contact relays or any unwanted noise from the machine can be heard.
- The equipment under test is easily accessible.
- Fire suppression equipment is easily accessible and in good condition.
- A first aid kit is available and in good condition.
- If loan working is required then this has been risk assessed and a suitable protocol is in place.

The workstation can be at a temporary outdoor location if all the above requirements are met.

Key features

Earthing and safety

- The Power Module enclosure is earthed to the supply and through the Safety Earth
- The Secondary side of the transformer is earth referenced.
- The input side of the transformer is tied between Live and Neutral.
- Each connector link used to couple the Treatment Return and Safety Earth are directly tied to Power Module enclosure.
- A single channel Industrial safety relay is used to interrupt the 24V coil drive signal to each of the three intermediary drive relays. The outputs of each intermediary drive relay loop through the mechanically linked normally closed contacts of the other two safety contactors to prevent multiple tapings on the primary side of the transformer being driven simultaneously. So, if High is being actively driven, the drives to the Medium and Low contactors are disabled.
- Each safety contactor is a three-pole variant and the transformer drive signal loops back through three times, so if any one of the three phase contacts fails closed two others remain to prevent injury. The auxiliary contacts of each contactor only close if all the three internal phase contacts open at de-energisation. Therefore, the system is fault tolerant to two phases of any single contactor failing closed.
- The industrial safety relay and its emergency stop are independent of all other control systems.
- No energy storage mechanisms are utilised in the high-power pathway.
- A Lance loopback is included to ensure the main Power Module to Treatment Lance cable is connected before the safety relay will turn on.

Deployment and access control

- Without Treatment Return and Safety Earth foot compression the system will remain open.
- If the safety relay is activated it is not possible to reset the system until, the E-Stop fault is cleared, and the foot compression is confirmed.

- An operator lockable 2 pole Isolator switch is used to control the supply of 230V AC into the Power Module. This Isolator can be padlocked in either the open or closed position.

Lance controls and operation

- The lance controls provide direct control to the low impedance input intermediary relays.
- 24V is switched through the safe stop relay through four normally open switches in the two triggers and through the High, Medium and Low voltage level selector switch.
- Directly coupled LEDs indicate when the High, Medium or Low control lines are actively driven by the Lance.
- On turn on the safe stop is off and will not operate until the reset button is pushed when the hands are clear of the triggers. This relay is latched on through the release contacts of each trigger switch.
- The Lance provides a configurable loop back pathway to ensure the lance remains connected to the Power Module. If this loop back is broken the Power Module system shuts down.

Energy conversion and application

- Distribution of the high voltage signal is via specialist conductor and jointing pathways.
- Double shielding is provided throughout (additional silicon outer sheath or non-conductive mechanical structure). In the Power Module, where insulating secondary protection is not possible, a directly earthed enclosure is used.
- The transformer is designed to run at 125 degrees (core temperature) and has three tapings to provide 3, 4 and 5 KV at the output.
- The internal temperature switch will shut down the whole 24V sub system (including safety relay) if tripped at a core temperature above 150 degrees centigrade.

Treatment Lance Mk3 APL-001-3

Figure 1 - Mk3 Treatment Lance shaft components diagram

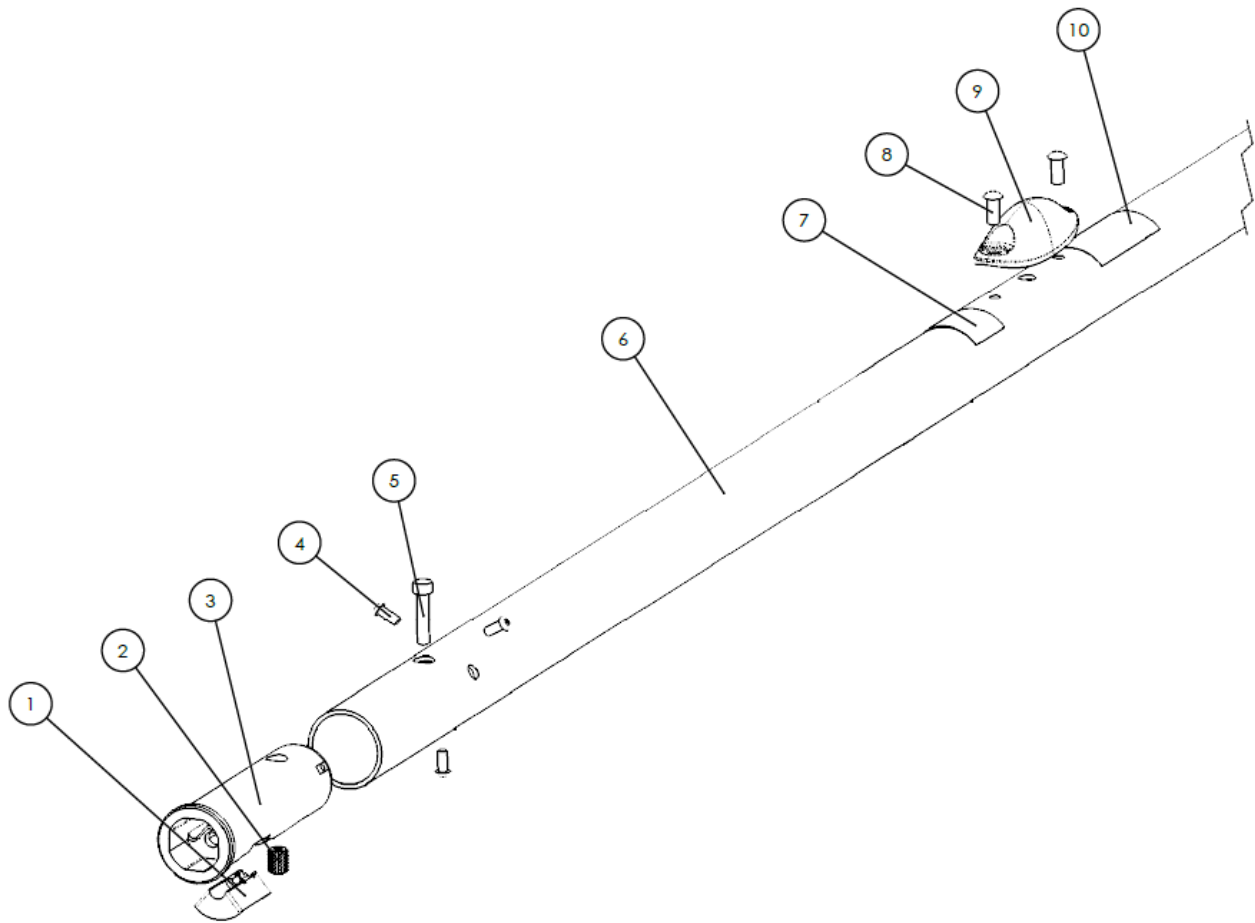


Figure 2 - Mk 3 Treatment Lance handle components diagram

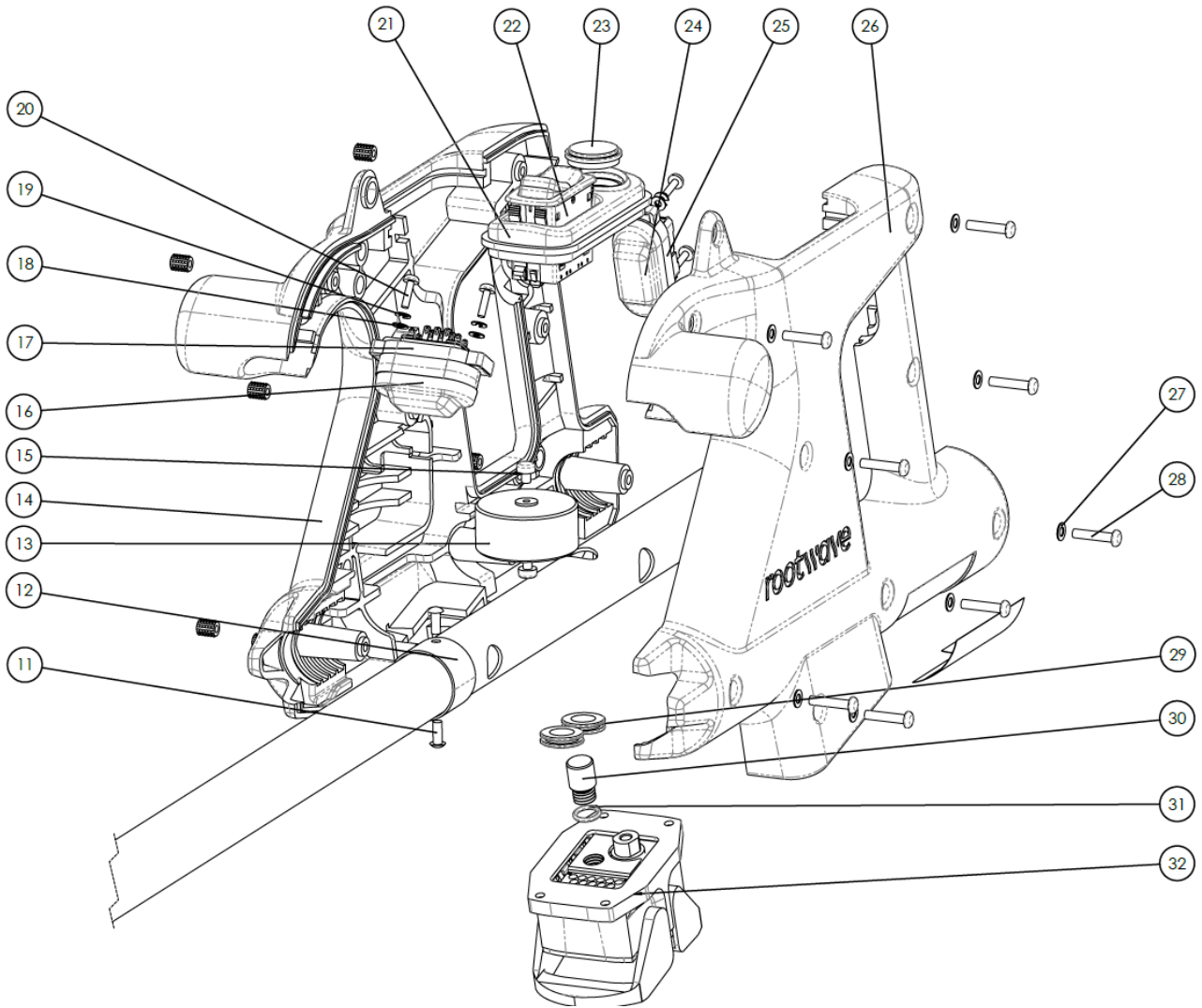


Figure 3 - Mk3 Treatment Lance shaft wires electrical components diagram

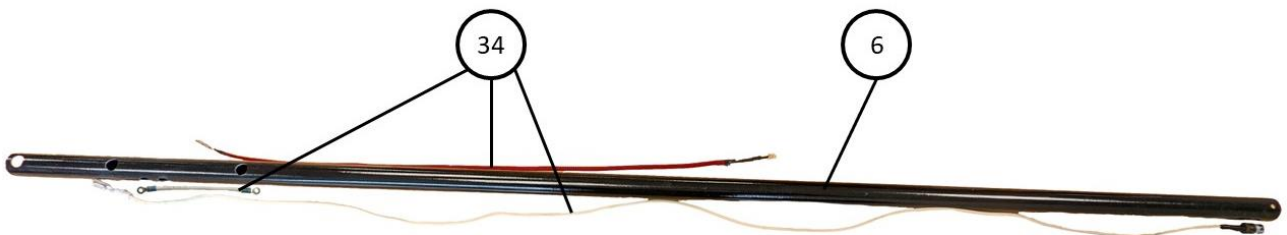


Figure 4 - Mk3 Treatment Lance handle electrical components diagram

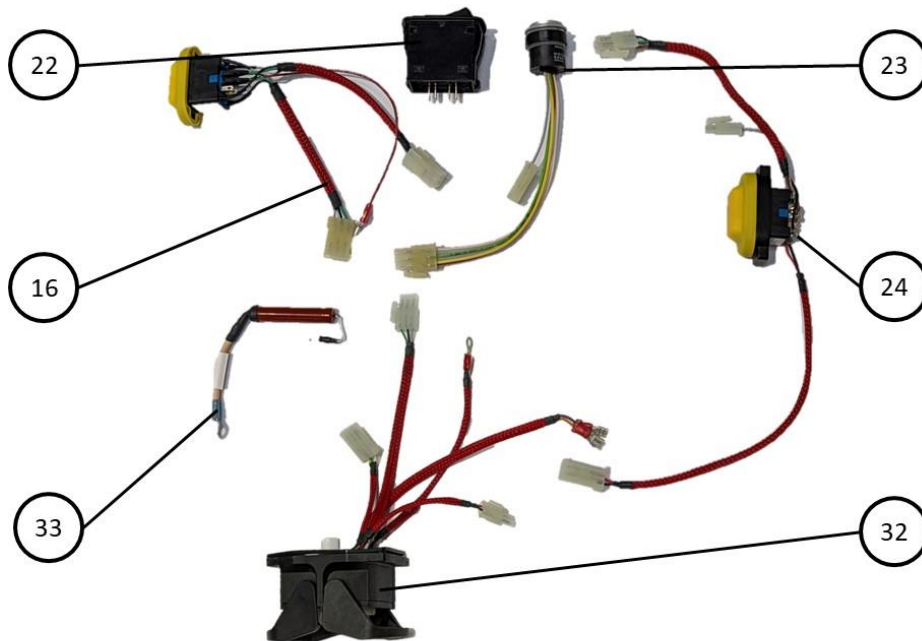


Table 1 - Mk3 Treatment Lance components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-PRO-MEC038	PRO TREATMENT LANCE ELECTRODE MODULE LOCK MK3	ROOTWAVE	1
2	137M4	M4 THREAD INSERT	ROOTWAVE	9
3	U-PRO-MEC037	PRO TREATMENT LANCE ELECTRODE MODULE SOCKET MK3	ROOTWAVE	1
4	ISO 7380-1 - M3 X 10	M3 HEXAGON SOCKET BUTTON HEAD SCREW - PRODUCT GRADE A	OFF THE SHELF	3
5	DIN 912 - M4 X 20	M4 CYLINDER HEAD CAP SCREW	OFF THE SHELF	1
6	U-TL_FGT003-E	PRO TREATMENT LANCE FIBRE GLASS TUBE MK3	ROOTWAVE	1
7	PRO_LABEL_10	25mm ELECTRICAL DANGER LABEL	ROOTWAVE	1
8	379-9646	RICHCO - NYLON CLINCH RIVET, 4mm	OFF THE SHELF	2

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
9	U-PRO-MEC052	PRO TREATMENT LANCE LED HOUSING MK3	ROOTWAVE	1
10	PRO_LABEL_05	PRO TREATMENT LANCE TUBE WARNING LABEL MK3	ROOTWAVE	1
11	SSD54SSBS	POP - 4MM X 10.2MM BLIND RIVET SS	OFF THE SHELF	2
12	U-TL_SR001	PRO TREATMENT LANCE SAFTEY SHUNT RING	ROOTWAVE	1
13	715C15DKS10	VISHAY - 10NF 15KVDC CERAMIC CAPACITOR	OFF THE SHELF	1
14	U-TL_HR002	PRO TREATMENT LANCE HANDLE RIGHT MK3	ROOTWAVE	1
15	SIP-8-32-3 16-A2	ACCU - 8-32 UNC X 3/16 INCH PHILLIPS PAN HEAD MACHINE SCREWS (ANSI B18.6.3) - STAINLESS STEEL (A2)	OFF THE SHELF	2
16	U-TL_SA5	PRO TREATMENT LANCE FRONT TRIGGER LOOM MK3	ROOTWAVE	1
17	U-TL_TCF002	PRO TREATMENT LANCE FRONT TRIGGER CARRIAGE MK3	ROOTWAVE	1
18	DIN 125 - A 3.2	M3 WASHER	OFF THE SHELF	4
19	DIN 127 - A 3	M3 SPRING WASHER	OFF THE SHELF	4
20	DIN 7985 (H) - M3X12-H	M3 CROSS RECESSED RAISED CHEESE HEAD SCREWS - TYPE H	OFF THE SHELF	4
21	U-TL_CP001	PRO TREATMENT LANCE CONTROL PANEL MK3	ROOTWAVE	1
22	L58B3S001-AZZRX-100	PEN COM ROCKER SWITCH MARKED LMH 24V 15A	ROOTWAVE	1
23	U-TL_SA2	PRO TREATMENT LANCE RESET SWITCH LOOM MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
24	U-TL_SA4	PRO TREATMENT REAR TRIGGER LOOM MK3	ROOTWAVE	1
25	U-TL_TCR001	PRO TREATMENT REAR TRIGGER CARRIAGE MK3	ROOTWAVE	1
26	U-TL_HL002	PRO TREATMENT LANCE LANCE HANDLE LEFT MK3	ROOTWAVE	1
27	DIN 6798 - A 4.3	M4 EXTERNAL SERRATED LOCK WASHER	OFF THE SHELF	10
28	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 20 - A2	M4 HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	8
29	2520057010	SES STERLING - BLACK POLYCHLOROPRENE 15mm ROUND CABLE GROMMET FOR MAXIMUM OF 11 mm CABLE DIA.	OFF THE SHELF	2
30	U-PRO-MEC050	PRO TREATMENT LANCE SHROUD BLANK INSERT MK3	ROOTWAVE	1
31	527-9807	RS PRO - SILICONE O-RING, 9.25mm BORE, 1/2IN OUTER DIAMETER	OFF THE SHELF	2
32	U-TL_SA1-G	PRO TREATMENT HV CONNECTOR LOOM MK3	ROOTWAVE	1
33	U-TL_SA3	PRO TREATMENT LANCE CAPACITOR LOOM MK3	ROOTWAVE	1
34	U-TL_LW1-E	PRO TREATMENT LANCE HV AND LED CABLES MK3	ROOTWAVE	1
35	131-22510 REL250-PA66-BK	HELLERMANN TYTON - BLACK CABLE TIE NYLON RELEASABLE, 250mm X 7.6 mm	OFF THE SHELF	1
36	664-2887	RS PRO - 71 X 1.6MM CABLE TIE BLACK	OFF THE SHELF	8

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
37	FTH-15-01	ESSENTRA COMPONENTS - 2.5-4.8MM CABLE TIE MOUNT	OFF THE SHELF	8

Treatment Lance APL-001-2 and Electrode Mk2

The following components are different in Mk2 from Mk3 specification.

Figure 4 - Mk2 Treatment Lance shaft components diagram

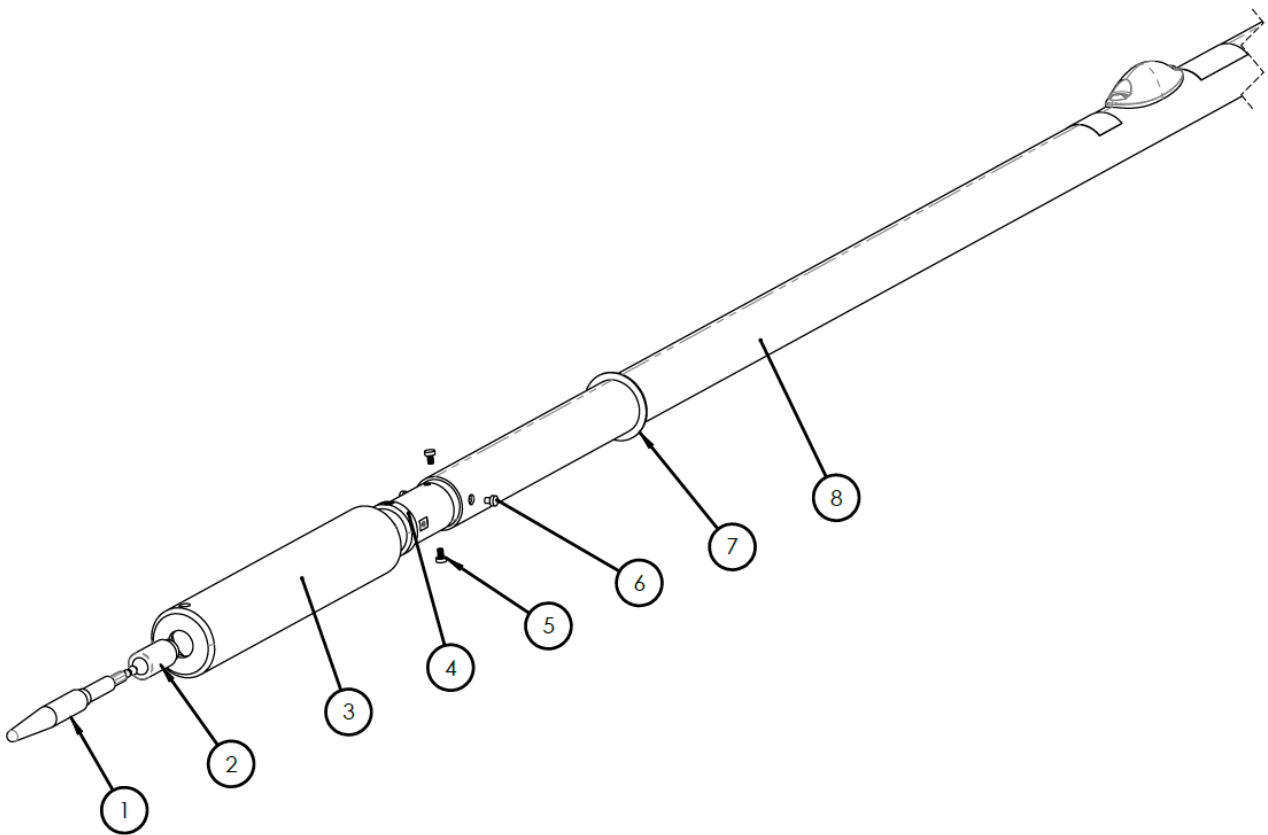


Figure 4 - Mk2 Treatment Lance handle components diagram

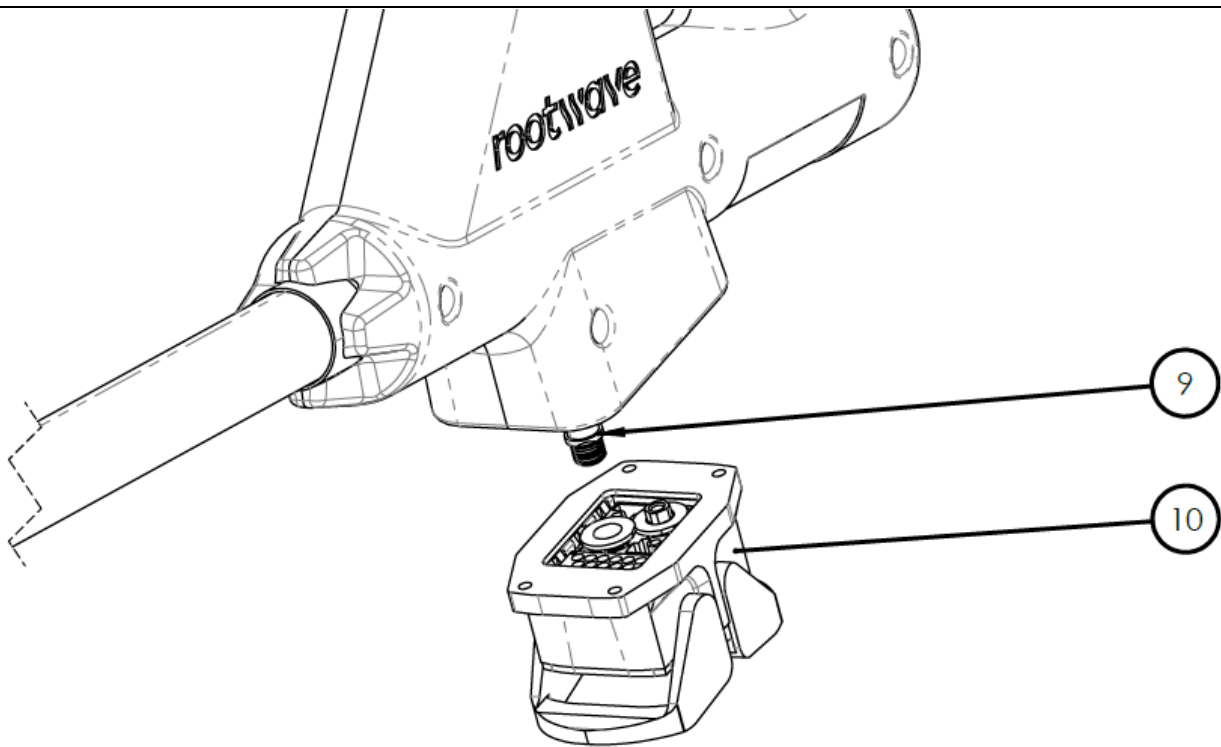
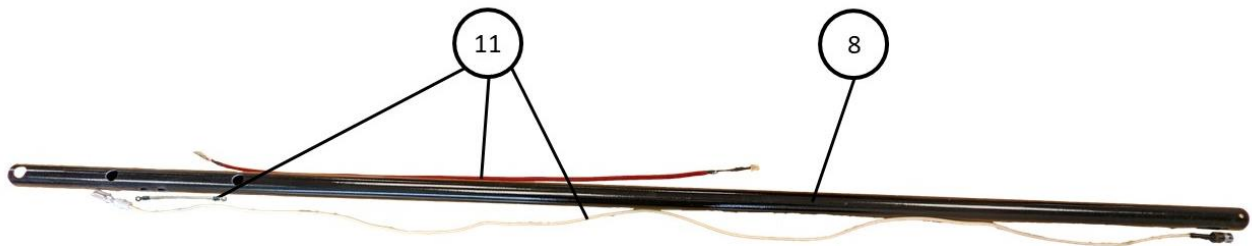


Table 2 - Mk3 Mk2 Treatment Lance components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-TL_ET001	PRO TREATMENT LANCE ELECTRODE MK2	ROOTWAVE	1
2	13N10	13N10 CERAMIC 3/8" 10mm	ROOTWAVE	1
3	U-TL_TP001	PRO TREATMENT LANCE ELECTRODE SLEEVE MK2	ROOTWAVE	1
4	U-TL_EH001	QUICK CONNECT ELECTRODE HOLDER	ROOTWAVE	1
5	SHC-M3-5-PK	ACCU - M3 X 5mm TORX CAP HEAD SCREWS - PEEK	OFF THE SHELF	2
6	DIN 7984 - M3 X 4	M3 - CYLINDER HEAD CAP SCREW	OFF THE SHELF	2
7	128-940	RS PRO - NITRILE RUBBER O-RING SEAL, 26.5mm BORE, 32.5mm OUTER DIAMETER	OFF THE SHELF	1
8	U-TL_FGT003_c	PRO TREATMENT LANCE TUBE MK2	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
9	U-HV_SI002	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT BLIND MK2	ROOTWAVE	1
10	U-TL_SA1-F	PRO TREATMENT LANCE HV CONNECTORLOOM MK2	ROOTWAVE	1
11	U-TL_LW1-D	PRO TREATMENT LANCE HV AND LED CABLES MK2	ROOTWAVE	1

Figure 5 – Mk2 treatment lance shaft wires



Treatment Lance Electrode Module Mk3 ETD-001-3

This section applies to all Mk3 Electrode Modules ETD-###-3. See latest spare price list for other electrode shapes.

Figure 6 - Mk3 Treatment Lance Electrode Module mechanical components diagram

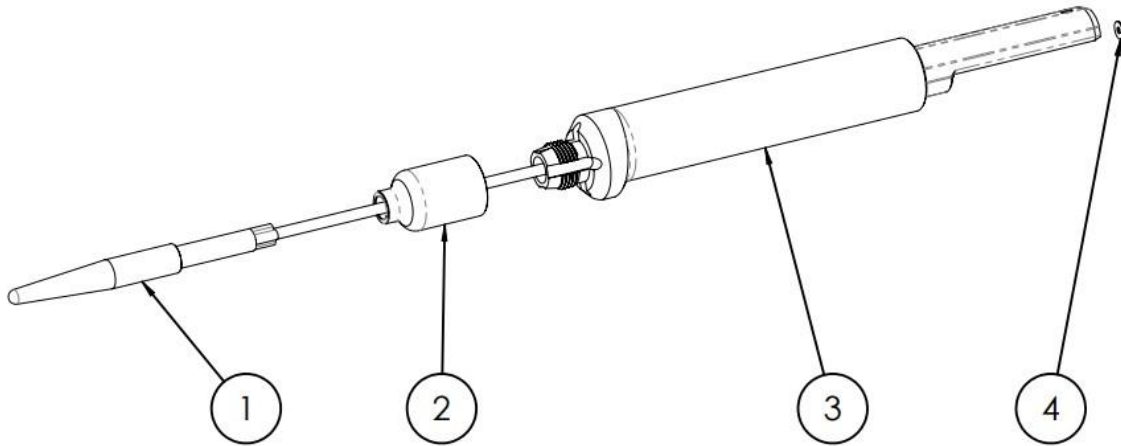


Table 3 - Mk3 Treatment Lance Electrode Module mechanical components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-PRO-MEC041	PRO TREATMENT LANCE STRAIGHT ELECTRODE MK3	ROOTWAVE	1
2	CERAMIC STDGAS LENS NO. 6 0.75IN - 10mm (WP9-20)	R-TECH ELECTRODE CERAMIC COLLAR	ROOTWAVE	1
3	U-PRO-MEC043	PRO TREATMENT LANCE ELECTRODE MODULE BODY MK3	ROOTWAVE	1
4	289-461	RS PRO - CIRCLIP, 4.5MM SHAFT DIAMETER, 3.2MM GROOVE DIAMETER	OFF THE SHELF	1

Treatment Return Mk3 GRW-001-3

Figure 7 - Mk3 Treatment Return mechanical components diagram

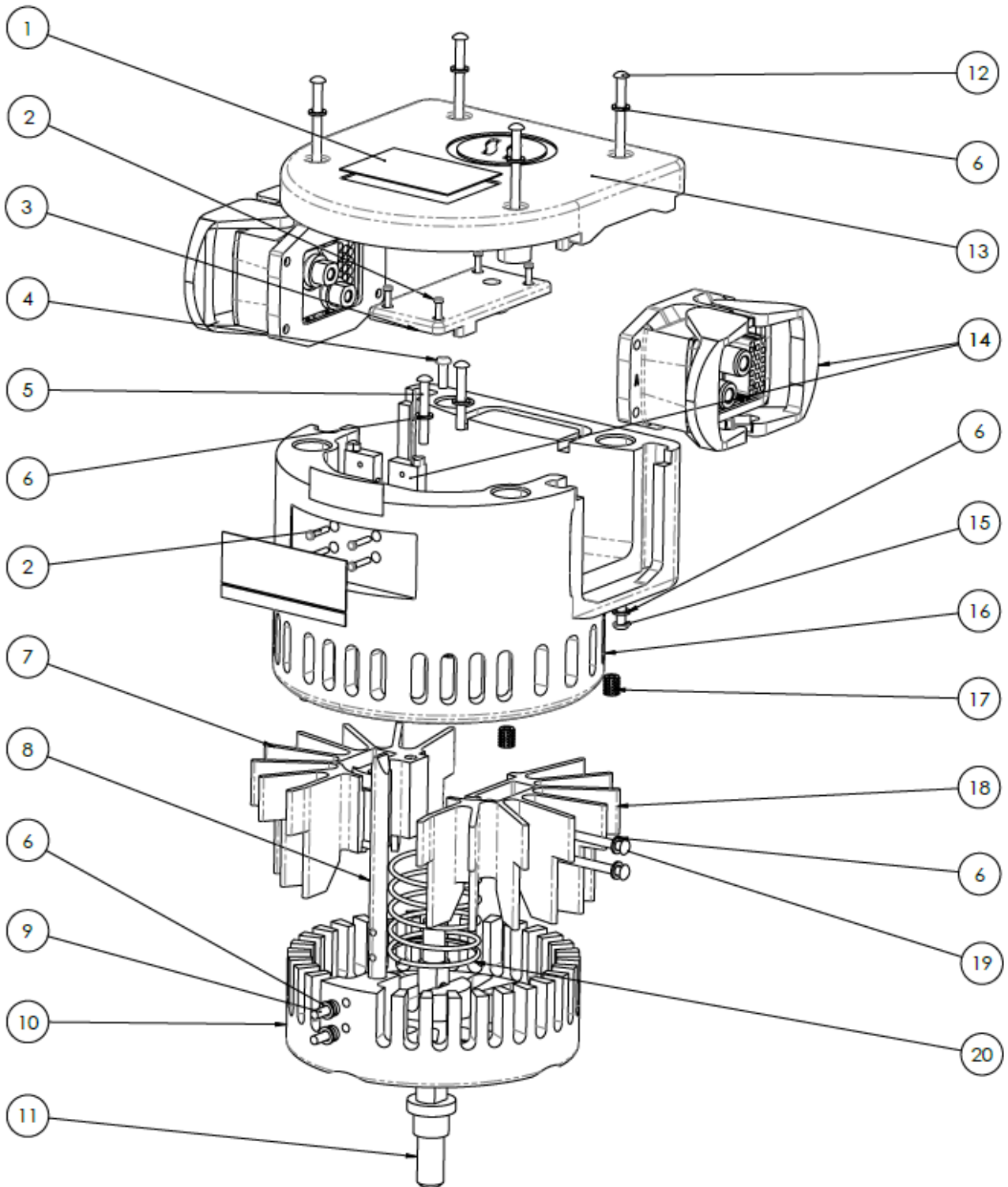


Table 4 - Mk3 Treatment Return components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	UBI01-PRO-LABEL-07	PRO TREATMENT RETURN SAFETY EARTH WARNING LABEL MK3	ROOTWAVE	1
2	2.5X12-POZ-PLAST-SS	2.5X12 MM POZI PAN HD PLASTITE A2 SCREW	OFF THE SHELF	8
3	U-TR_CVR001	PRO TREATMENT RETURN COVER MK3	ROOTWAVE	1
4	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 12 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	1
5	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 30 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	2
6	DIN 6797 - A 4.3	M4 - TOOTHED LOCK WASHER	OFF THE SHELF	12
7	U-TR_HSL001_B	PRO TREATMENT RETURN HEATSINK LEFT MK3	ROOTWAVE	1
8	U-TR_SR001_B	PRO TREATMENT RETURN SWITCH ROD MK3	ROOTWAVE	1
9	DIN 912 - M4 X 12	M4 - CYLINDER HEAD CAP SCREW	OFF THE SHELF	2
10	U-PRO-MEC018	PRO TREATMENT RETURN FOOT MK3	ROOTWAVE	1
11	U-PRO-MEC017	PRO TREATMENT RETURN BOLT MK3	ROOTWAVE	1
12	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 60 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	4
13	U-PRO-MEC040	PRO TREATMENT RETURN LID MK3	ROOTWAVE	1
14	U-TR_SA1-I	PRO TREATMENT RETURN SUB ASSY LOOM 1 MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
15	Hexalobular socket pan head screw ISO 14583 - M4 x 12 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583		2
16	U-TR_MB001	PRO TREATMENT RETURN MID-BODY MK3	ROOTWAVE	1
17	137M4	M4 THREAD INSERT	ROOTWAVE	6
18	U-TR_HSR001_B	PRO TREATMENT RETURN HEATSINK RIGHT MK3	ROOTWAVE	1
19	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 40 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	2
20	LP 080X 01 S316	LEE SPRING - COMPRESSION SPRING	OFF THE SHELF	1

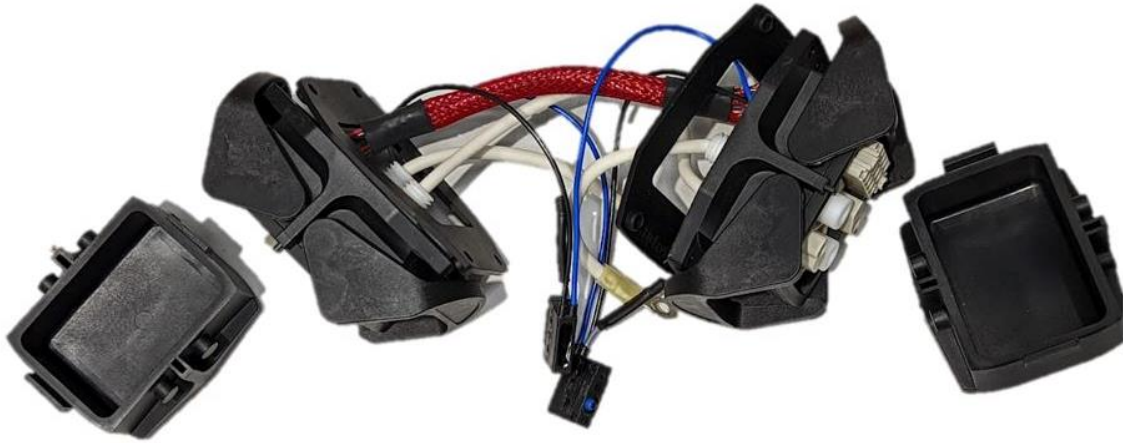
Figure 8 – Balloon item 14, U-TR_SA1-I, PRO TREATMENT RETURN SUB ASSY LOOM 1 MK3 (note revision I/i)



Treatment Return Mk2 GRW-001-2

The only difference between Mk3 and Mk2 is the wiring loom, where Revision F is used. See also section 'Treatment cable connectors' on page 41.

Figure 9 – Balloon item 14, U-TR_SA1-F, PRO TREATMENT RETURN SUB ASSY LOOM 1 MK2 (note revision F)



Safety Earth Mk2 and 3 GRW-002-3

Mk3 and Mk2 are identical.

Figure 10 - Mk3 Safety Earth components diagram

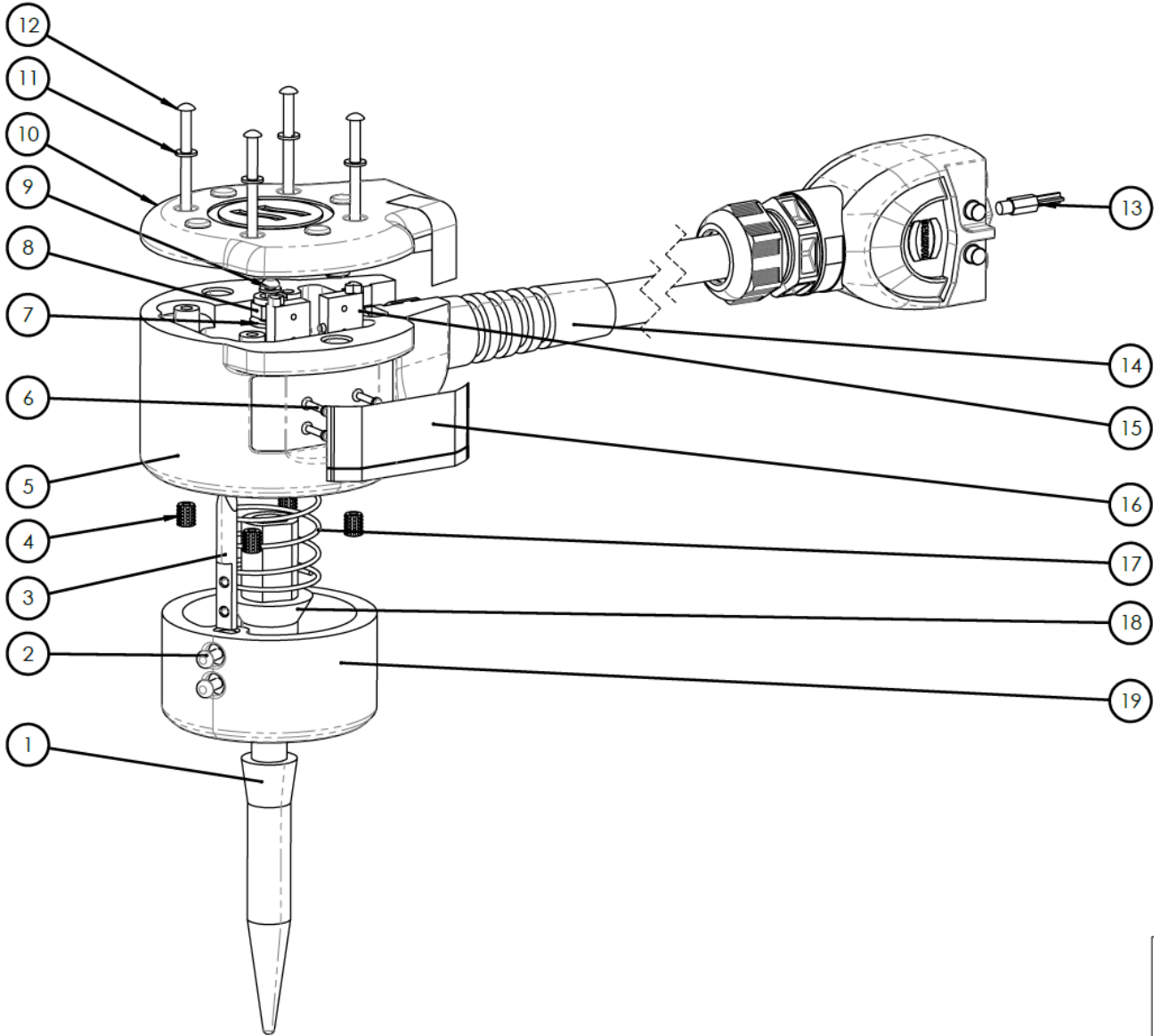


Table 5 - Mk3 Safety Earth components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-SE_GS001	PRO SAFETY EARTH GROUND SPIKE MK3	ROOTWAVE	1
2	4X12-HEXALOBULAR-PLAST-SS	4X12 MM HEXALOBULAR PAN HD PLASTITE A2 SCREW	OFF THE SHELF	2
3	U-SE_SR001	PRO SAFETY EARTH SWITCH ROD MK3	ROOTWAVE	1
4	137M4	M4 THREAD INSERT	ROOTWAVE	4
5	U-SE_MB001	PRO SAFETY EARTH BODY MK3(SUPPLIED WITH WARNING LABEL)	ROOTWAVE	1
6	2.5X12-POZ-PLAST-SS	2.5X12 MM POZI PAN HD PLASTITE A2 SCREW	OFF THE SHELF	4
7	DIN 125 - A 8.4	M8 - WASHER	OFF THE SHELF	1
8	DIN 985 - M8	M8 - HEX LOCK NUT	OFF THE SHELF	1
9	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 12 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	1
10	U-SE_LID001	PRO SAFETY EARTH LID MK3	ROOTWAVE	1
11	DIN 6798 - A 4.3	M4 - SERRATED LOCK WASHER	OFF THE SHELF	5
12	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 60 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	4
13	9120009901	HARTING - MALE CODING PIN, HAN Q SERIES , FOR USE WITH HEAVY DUTY POWER CONNECTORS	OFF THE SHELF	1
14	U-CBLE001	PRO SAFETY EARTH CABLE 4m MK3	ROOTWAVE	1
15	U-SE_SA1	PRO SAFETY EARTH ASSEMBLY LOOM 1 MK3	ROOTWAVE	1
16	PRO_LABEL_07	PRO TREATMENT RETURN AND SAFETY EARTH WARNING LABEL MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
17	LEESPRING-LP 067X 01 S316	LEE SPRING - COMPRESSION SPRING	OFF THE SHELF	1
18	U-SS001	PRO SAFETY EARTH SPIKE SLEEVE MK3	ROOTWAVE	1
19	U-SE_BF001	PRO SAFETY EARTH FOOT MK3	ROOTWAVE	1

Power Module Mk3 TRA-001-3

Figure 11 - Mk3 Power Module components diagram

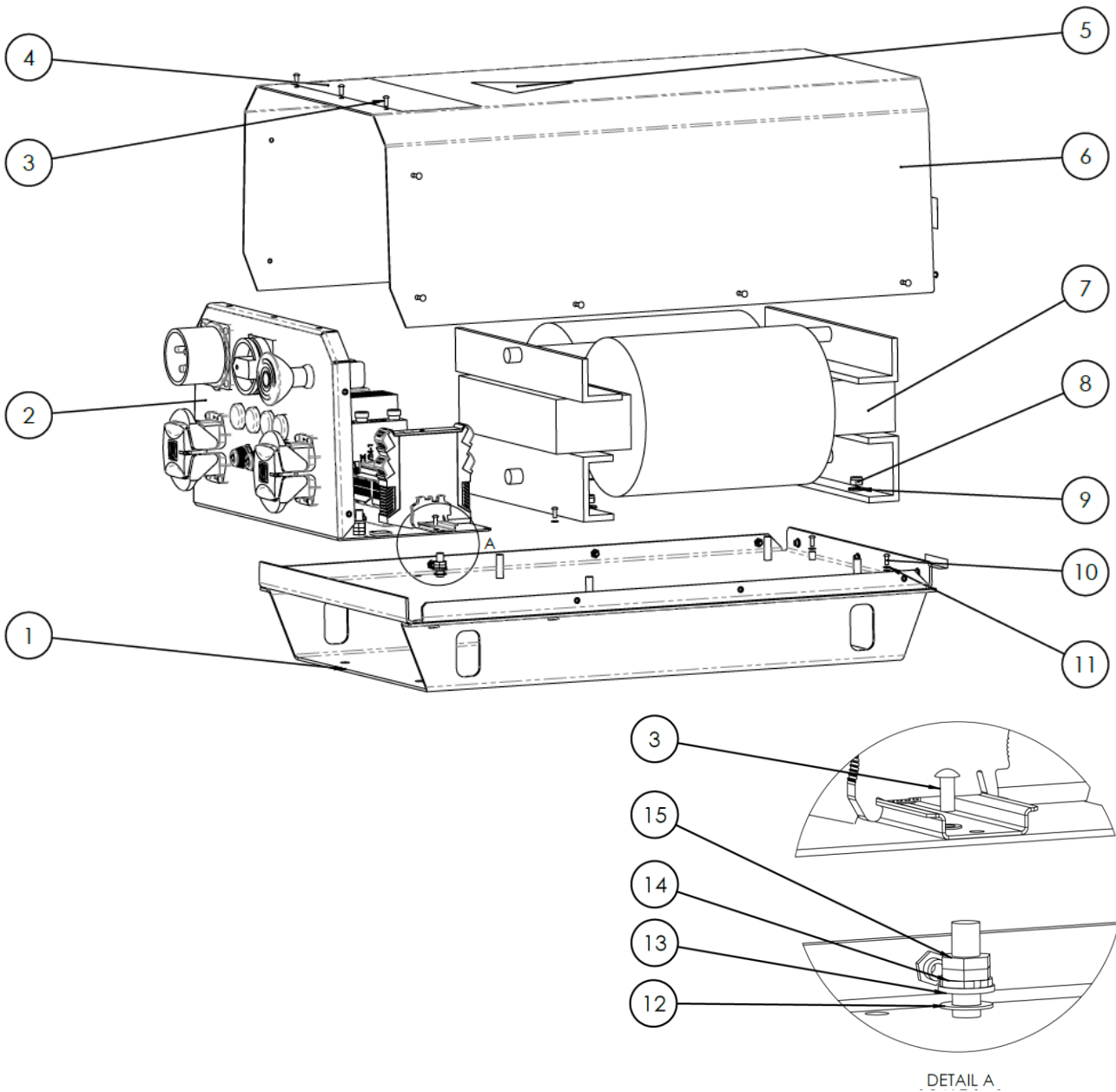


Table 6 – Mk3 Power Module components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-PRO-MEC025	PRO POWER MODULE CHASSIS BASE MK3	ROOTWAVE	1
2	PRO-SPR-001	PRO POWER MODULE FRONT PANEL MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
3	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 10 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	26
4	PRO_LABEL_04	PRO POWER MODULE WARNING LABEL MK3	ROOTWAVE	1
5	PRO_LABEL_08	120mm ELECTRICAL DANGER LABEL	ROOTWAVE	1
6	U-PRO-MEC026	PRO POWER MODULE CHASSIS LID MK3	ROOTWAVE	1
7	30502	5KVA 1PH 50HZ TRANSFORMER	ROOTWAVE	1
8	DIN 985 - M8	M8 - HEX LOCK NUT	OFF THE SHELF	4
9	DIN 9021 - 8.4	M8 WASHER	OFF THE SHELF	4
10	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 8 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	2
11	DIN 6797 - J 4.3	M4 - TOOTHED LOCK WASHER	OFF THE SHELF	6
12	DIN 6797 - J 8.4	M8 - TOOTHED LOCK WASHER)	OFF THE SHELF	1
13	DIN 125 - A 8.4	M8 - WASHER	OFF THE SHELF	1
14	DIN 127 - A 8	M8 - SPRING WASHER	OFF THE SHELF	1
15	DIN 934 - M8	M8 - HEX NUT	OFF THE SHELF	2
16	489-214	RS PRO - M5 16X20X0.2 BRAIDED EARTH LEAD 200MM	OFF THE SHELF	2
17	FVWS5.5-8	JST - 8MM RING CRIMP YELLOW	OFF THE SHELF	3
18	6MM-TRI-GREEN- YELLOW	6MM TRI-RATED BS6231CK WIRE GN/YE	OFF THE SHELF	1
19	FVWS5.5-6	JST - 6MM RING CRIMP YELLOW	OFF THE SHELF	1
20	664-2887	RS PRO - 71X1.6MM CABLE TIE BLACK	OFF THE SHELF	2

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
21	811-1729	RS PRO - SELF ADHESIVE BLACK CABLE TIE MOUNT 29.2 mm X 29.2mm, 5.5mm MAX. CABLE TIE WIDTH	OFF THE SHELF	1

Figure 12 - Mk3 Power Module photo

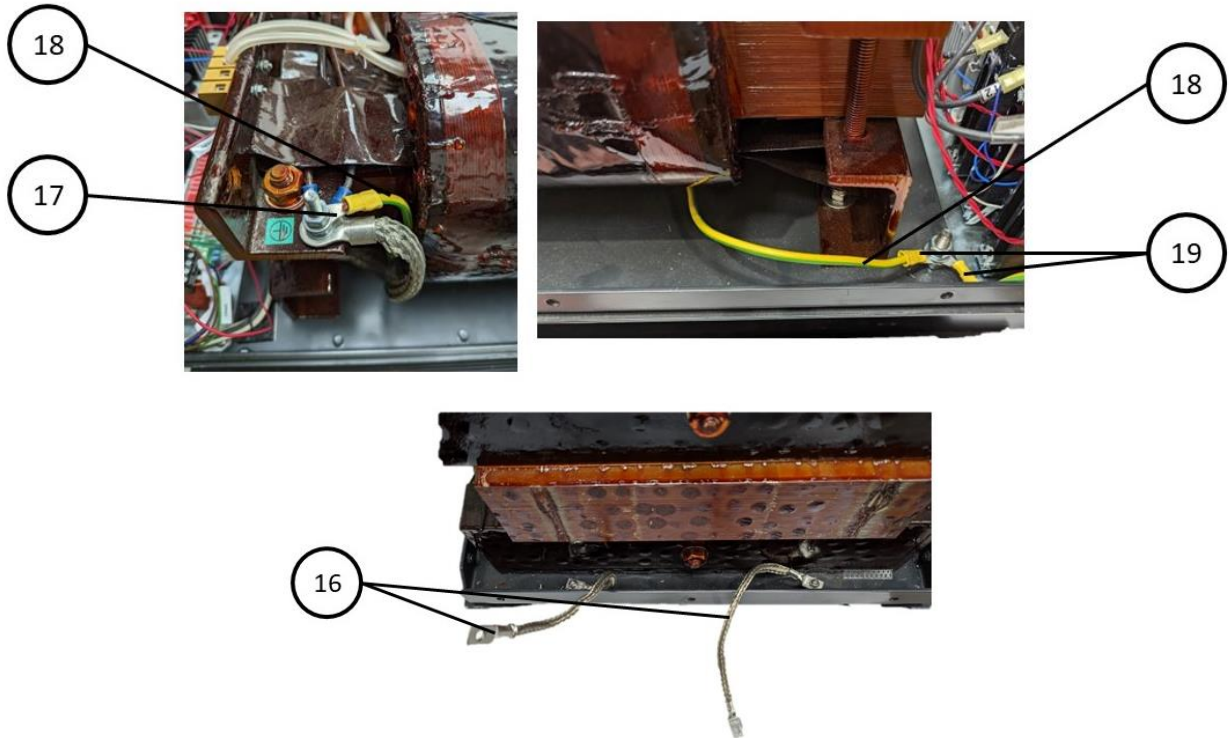


Figure 13 - Mk3 Power Module front panel EXTERNAL components diagram

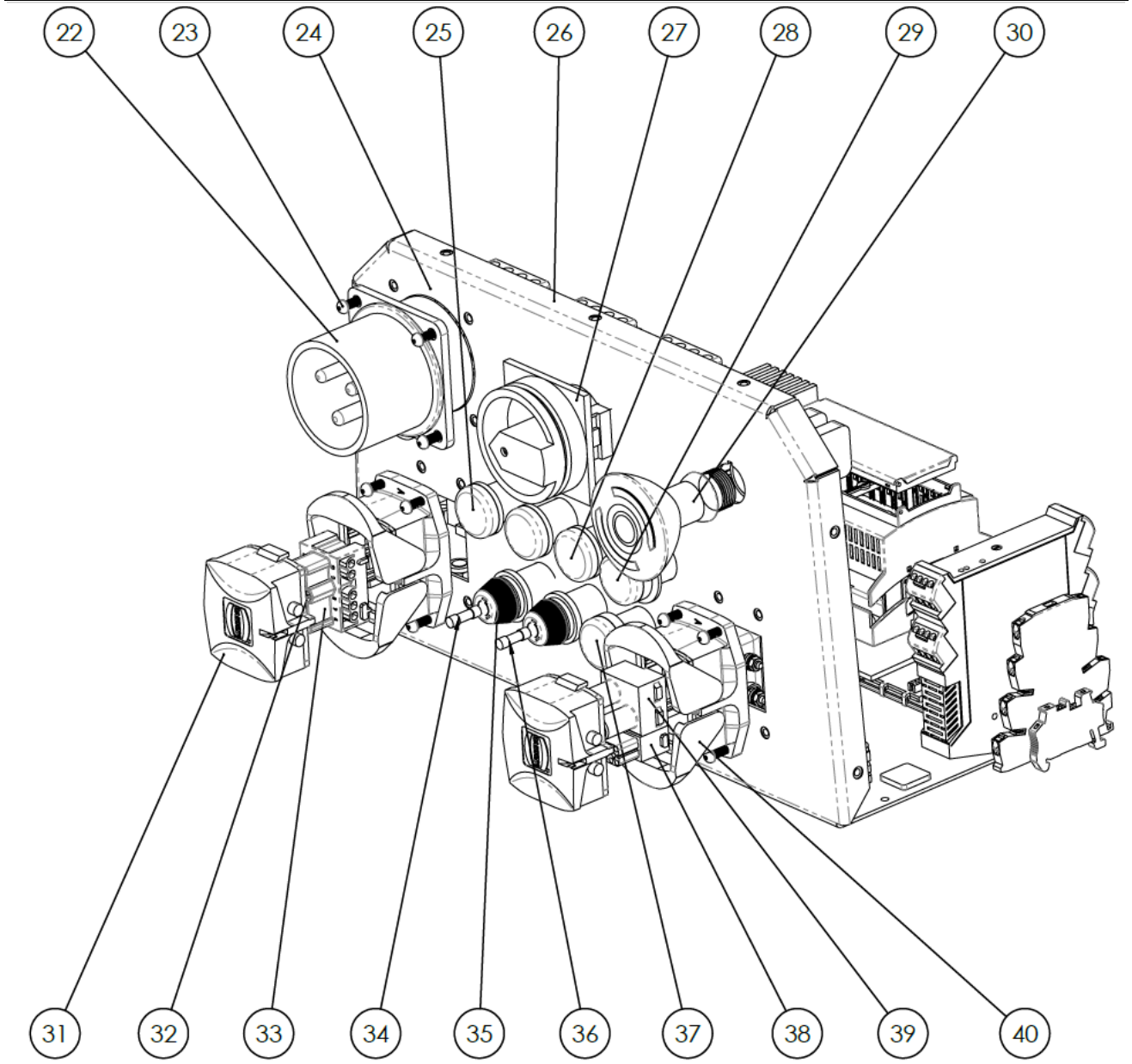


Figure 14 - Mk3 Power Module front panel INTERNAL components diagram

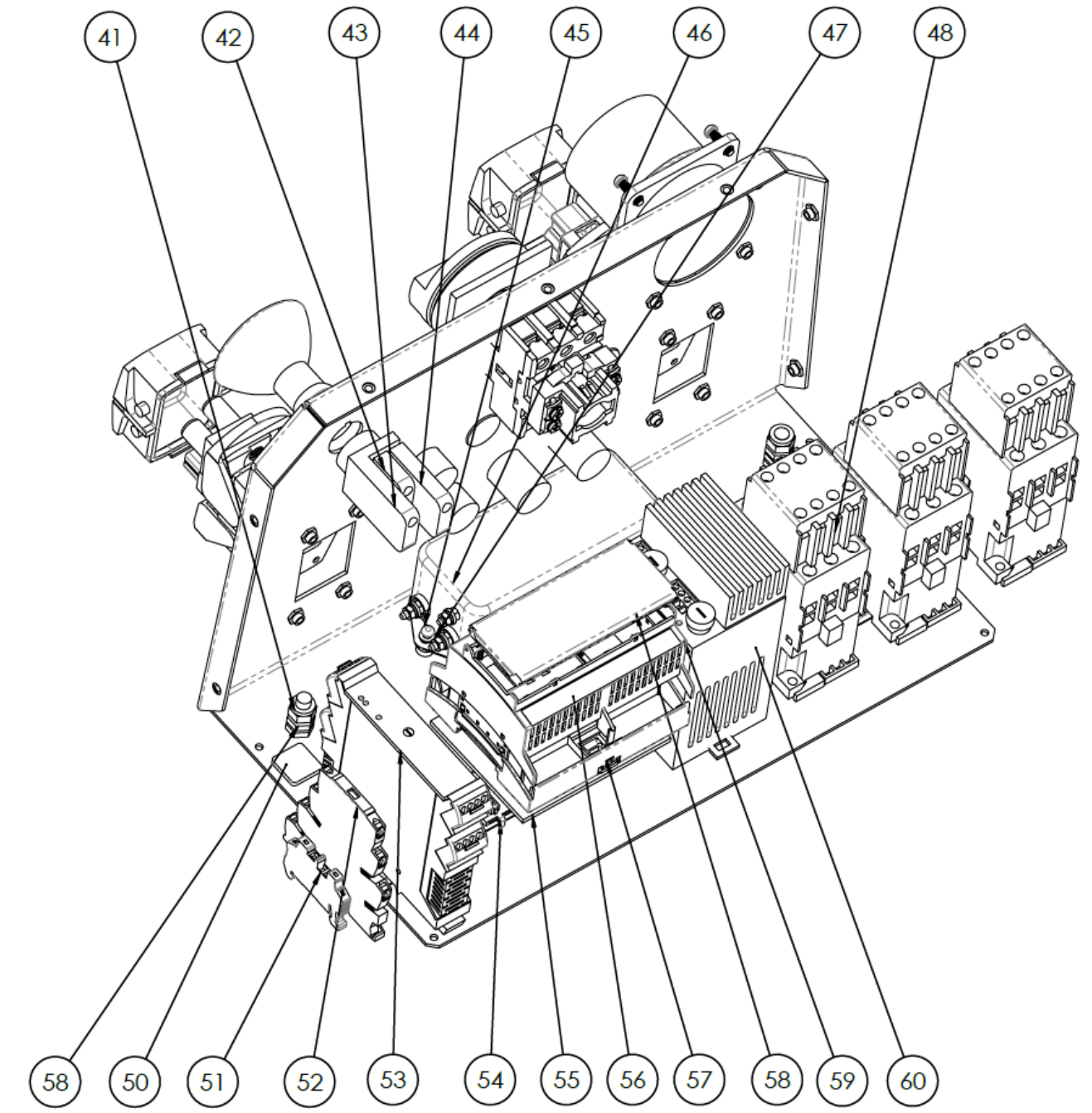
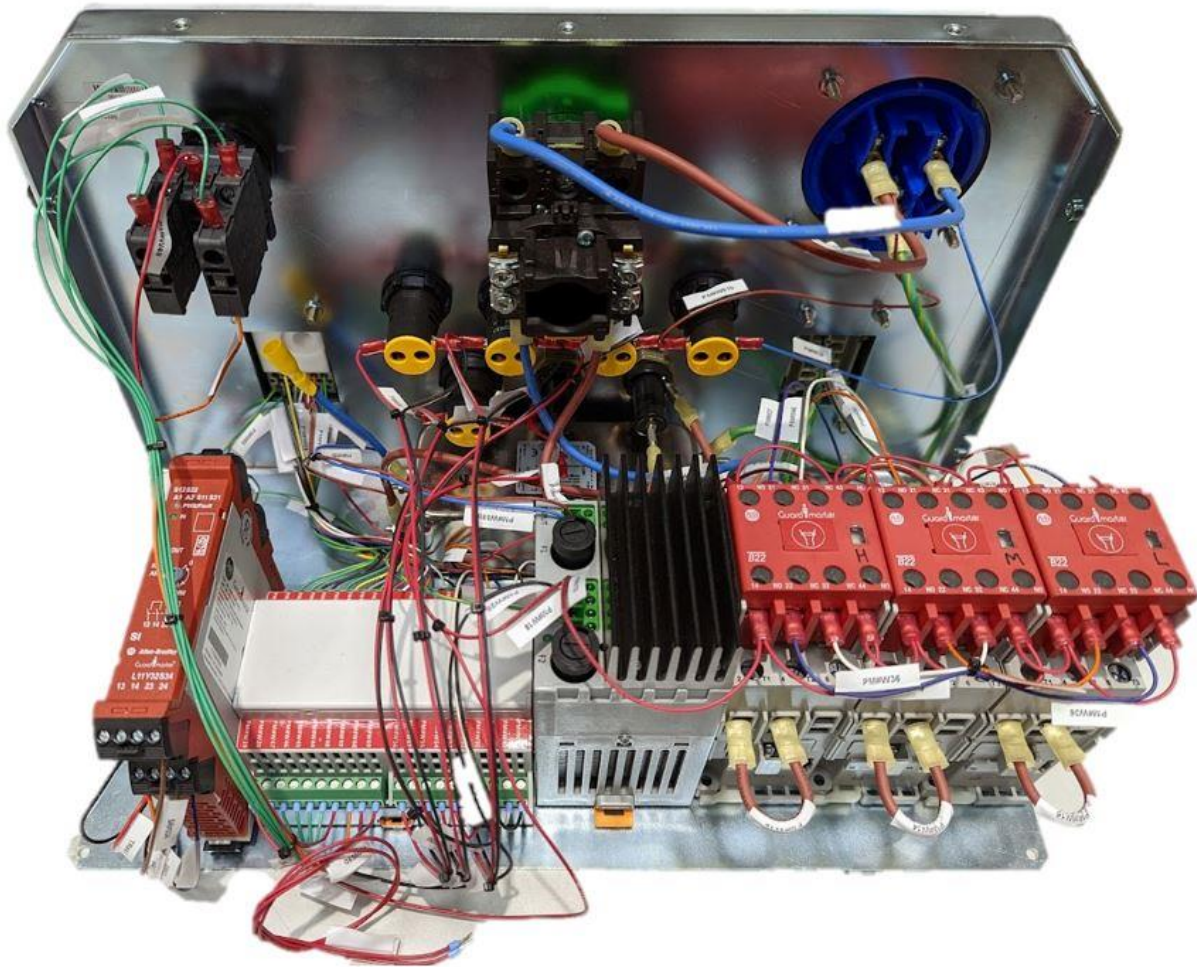


Figure 15 - Mk3 Power Module front panel photo



For Front Panel wiring see section 'Power module wiring'

Table 7 - Mk3 Power Module front panel components list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
22	2CMA193434R1000 232BU6	ABB - 2CMA193434R1000-232BU6 POWER SOCKET	OFF THE SHELF	1
23	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 16 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	12
24	U-PRO-LAB001	PRO POWER MODULE FRONT PANEL LABEL MK3	ROOTWAVE	1
25	RAD223B	MULTICOMP - LED PANEL MOUNT GREEN 22MM 24V	OFF THE SHELF	2
26	U-PRO-MEC027	PRO POWER MODULE CHASSIS FRONT PANEL MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
27	081438 P1-32/EA/SVB	EATON - 3POLE 32A 15KW ISOLATOR SWITCH	OFF THE SHELF	1
28	RAD223P	MULTICOMP - LED PANEL MOUNT GRN 22MM 230V	OFF THE SHELF	1
29	RAD225B	MULTICOMP - LED PANEL MOUNT AMBER 22MM 24V	OFF THE SHELF	1
30	800FP-MT64	ALLEN BRADLEY - 800FP-MT64 PUSH BUTTON	OFF THE SHELF	1
31	19410065404	HARTING - HAN ECO SERIES PROTECTION COVER	OFF THE SHELF	2
32	9120009902	HARTING - CODING PIN, HAN Q SERIES 8 WAY, FOR USE WITH HEAVY DUTY POWER CONNECTORS	OFF THE SHELF	1
33	19410102701	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR INSERT, 10 CONTACTS, 16A, FEMALE	OFF THE SHELF	1
34	E213099	MERSEN - 25A CERAMIC CARTRIDGE FUSE, 10 X 38mm	OFF THE SHELF	1
35	HPG	COOPER BUSSMANN - PANEL MOUNT FUSE HOLDER	OFF THE SHELF	2
36	KTK-3/4	EATON - BUSSMANN CARTRIDGE FUSE F 750MA	OFF THE SHELF	1
37	RAD224B	MULTICOMP - LED PANEL MOUNT RED 22MM 24V	OFF THE SHELF	1
38	9140173101	HARTING - HAN-MODULAR HEAVY DUTY POWER CONNECTOR MODULE, 17 CONTACTS, 10A, FEMALE	OFF THE SHELF	1
39	U-PRO-MEC047	PRO HIGH VOLTAGE CONNECTOR DOUBLE FEMALE MODULE MK3	ROOTWAVE	1
40	19410060301	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	2
41	DIN 985 - M8	M8 - HEX LOCK NUT	OFF THE SHELF	2
42	800F-X01	ALLEN BRADLEY - 800F-X01 CONTACT BLOCK FOR 800FM SERIES	OFF THE SHELF	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
43	800F-PX01S	ALLEN BRADLEY - 800F-PX01S CONTACT BLOCK FOR 800F SERIES	OFF THE SHELF	1
44	800F-X01S	ALLEN BRADLEY - 800F CONTACT BLOCK - 1NC 690 V	OFF THE SHELF	1
45	HEXALOBULAR SOCKET PAN HEAD SCREW ISO 14583 - M4 X 6 - A2	M4 - HEXALOBULAR SOCKET PAN HEAD SCREWS ISO 14583	OFF THE SHELF	2
46	FN2070-36-08	SCHAFFNER - FN2070 36A 250 V AC 400Hz, CHASSIS MOUNT EMI FILTER, STUD, SINGLE PHASE	OFF THE SHELF	1
47	DIN 6798 - A 4.3	M4 - SERRATED LOCK WASHER	OFF THE SHELF	2
48	100S-C37EJ22C	ALLEN BRADLEY - 100S-C 3 POLE SAFETY CONTACTOR - 37 A, 24 V DC COIL, 2NO + 2NC	OFF THE SHELF	3
58	DIN 439 - M8	M8 HEX THIN NUT	OFF THE SHELF	5
50	811-1729	RS PRO - SELF ADHESIVE BLACK CABLE TIE MOUNT 29.2 mm X 29.2mm, 5.5mm MAX. CABLE TIE WIDTH	OFF THE SHELF	1
51	3022276	PHOENIX CONTACT - CLIPFIX ATEX TERMINAL BRACKET FOR TERMINAL BLOCK	OFF THE SHELF	1
52	2901489	PHOENIX CONTACT - SPDT TIMER RELAY, FLASHER 0.1 → 10S, DIN RAIL MOUNT	OFF THE SHELF	1
53	440R-S12R2	ROCKWELL AUTOMATION - GUARDMASTER 24V DC SAFETY RELAY - DUAL CHANNEL WITH 2 SAFETY CONTACTS , 1 AUXILIARY CONTACT	OFF THE SHELF	1
54	HBUS 107,6-16P-1S BK	PHOENIX CONTACT - DIN RAIL BUS CONNECTOR	OFF THE SHELF	1
55	U-PMPCB01	PRO POWER MODULE PCB MK3	ROOTWAVE	1
56	PRO_LABEL_11	PRO POWER MODULE PCB WIRING LABEL MK3	ROOTWAVE	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
57	BC 107,6 UT HBUS BK	PHOENIX CONTACT - 49 X 107.6 X 89.7MM PLASTIC ENC	OFF THE SHELF	1
58	BC 107,6 DKL R KMGY	PHOENIX CONTACT - 107.6MM POLYCARB HOUSING COVER	OFF THE SHELF	1
59	BC 107,6 OT U11 KMGY	PHOENIX CONTACT - 62.2 X 107.6 X 89.7MM PLAST ENC	OFF THE SHELF	1
60	GLS230/24-1	BLOCK - GLS LINEAR DIN RAIL POWER SUPPLY 230V AC INPUT, 24V DC OUTPUT, 1A 24W	OFF THE SHELF	1
61	PRO_WIRING_SPEC_01	PRO POWER MODULE LOOSE WIRES MK3	ROOTWAVE	1
62	5664-2887	RS PRO - 71X1.6MM CABLE TIE BLACK	OFF THE SHELF	23

Mk2 enclosure spares are not available. For significant damage to Mk2 enclosure, then Mk3 enclosure and front panel must be used.

Treatment cable connectors

Figure 16 - Double MALE HV connector module, Mk3, for treatment cable component diagram

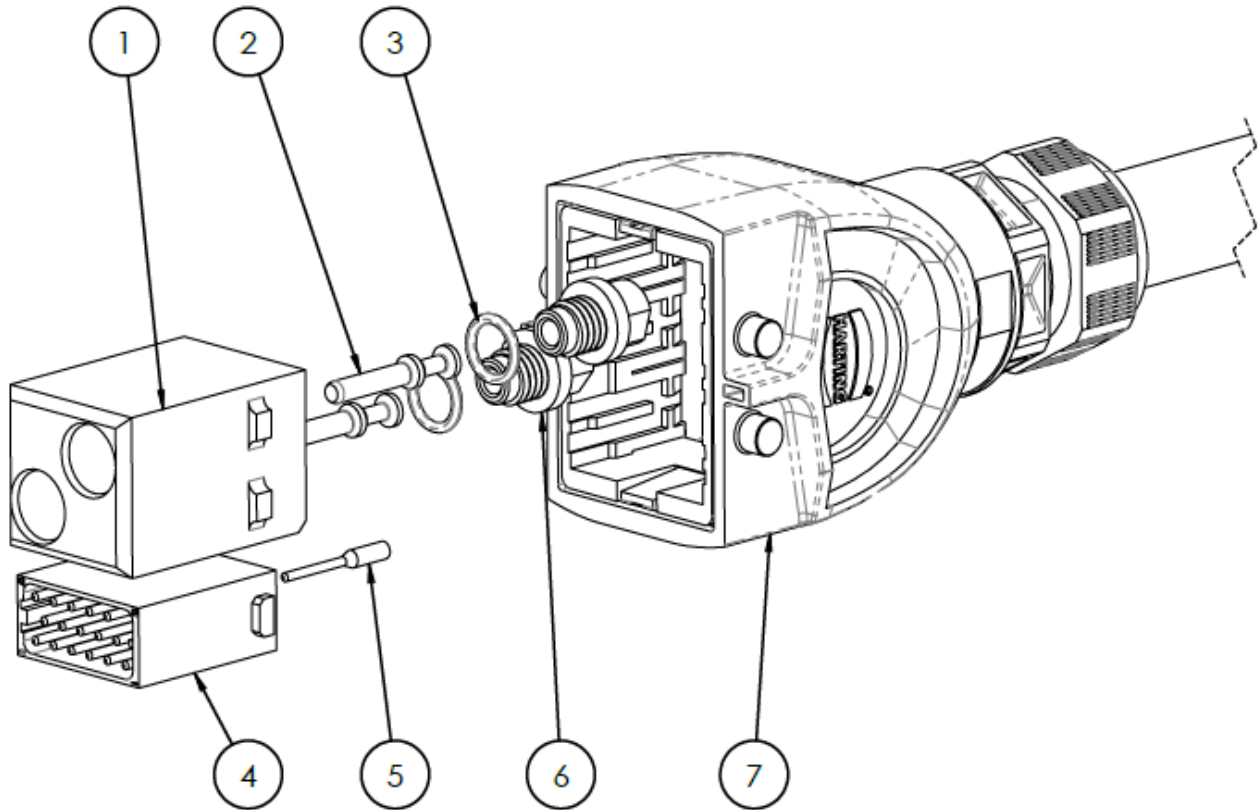


Table 8 - Double MALE HV connector module, Mk3, for treatment cable component list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	U-PRO-MECO48	PRO HIGH VOLTAGE CONNECTOR DOUBLE MALE MODULE MK3	ROOTWAVE	1
2	9320006104	HARTING - HAN C MALE 40A CRIMP CONTACT	OFF THE SHELF	2
3	527-9807	RS PRO - SILICONE O-RING, 9.25mm BORE, 1/2IN OUTER DIAMETER	OFF THE SHELF	2
4	9140173001	HARTING HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, MALE	OFF THE SHELF	1
5	9150006204	HARTING - CRIMP CONTACT, HAN CONTACTS FEMALE, 1 WAY, RATED AT 10A, HAN CD, HAN COM, HAN D, HAN DD, HAN DDD, HAN Q	OFF THE SHELF	17

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
6	U-PRO-MEC049	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK3	ROOTWAVE	2
7	19411060422	HARTING HAN-ECO TOP ENTRY HEAVY DUTY POWER CONNECTOR HOOD	OFF THE SHELF	1

Figure 17 - Double FEMALE HV connector module, Mk3, for Power Module and Treatment Return component diagram

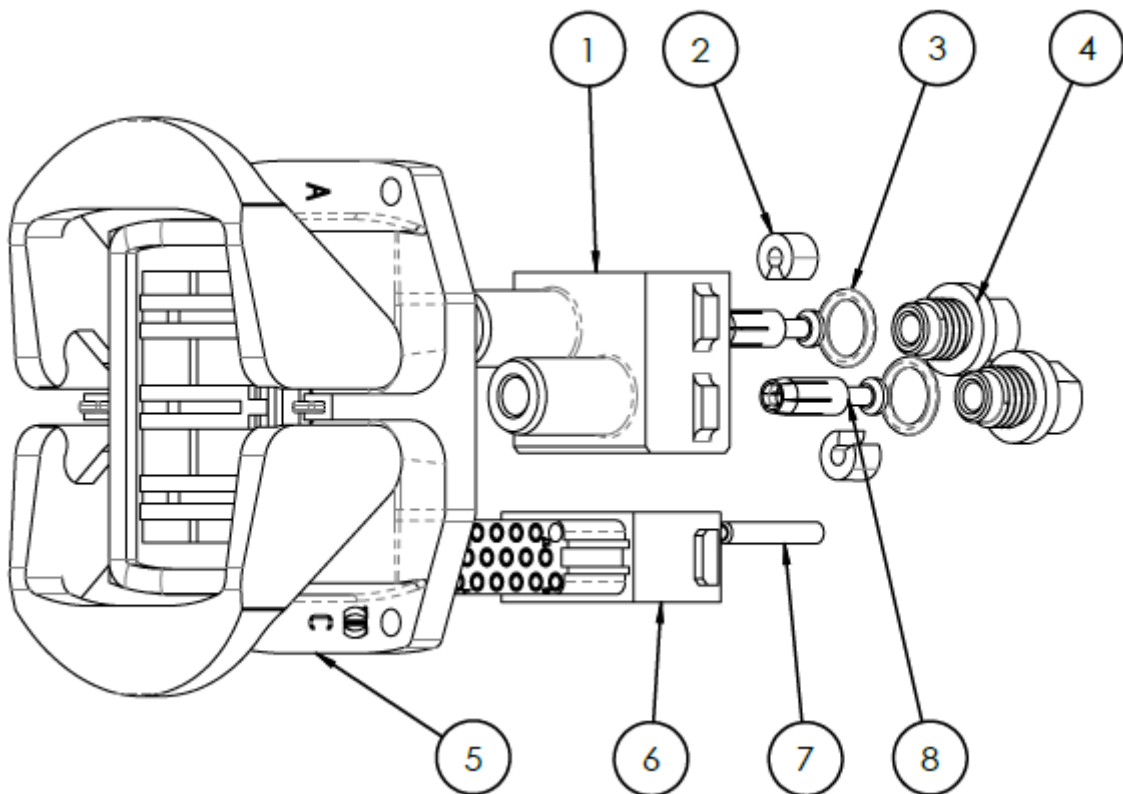


Table 9 - Double FEMALE HV connector module, Mk3, for Power Module and Treatment Return component list

ITEM NO.	PART NUMBER	DESCRIPTION	ROOTWAVE/ OFF THE SHELF	QTY.
1	U-PRO-MEC047	PRO HIGH VOLTAGE CONNECTOR DOUBLE FEMALE MODULE MK3	ROOTWAVE	1
2	U-HV_SC001	PRO HV CONNECTOR SHROUD COLLET MK3	ROOTWAVE	2

ITEM NO.	PART NUMBER	DESCRIPTION	ROOTWAVE/ OFF THE SHELF	QTY.
3	527-9807	RS PRO - SILICONE O-RING, 9.25mm BORE, 1/2IN OUTER DIAMETER	OFF THE SHELF	2
4	U-PRO-MEC049	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK3	ROOTWAVE	2
5	19410060301	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1
6	9140173101	HARTING - HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, FEMALE	OFF THE SHELF	1
7	9150006204	HARTING - CRIMP CONTACT, HAN CONTACTS FEMALE, 1 WAY, RATED AT 10A, HAN CD, HAN COM, HAN D, HAN DD, HAN DDD, HAN Q	OFF THE SHELF	17
8	9320006204	HARTING - HAN 40A 830V FEMALE CRIMP	OFF THE SHELF	2

Figure 18 - SINGLE FEMALE HV connector module, Mk3, for Treatment Lance component diagram

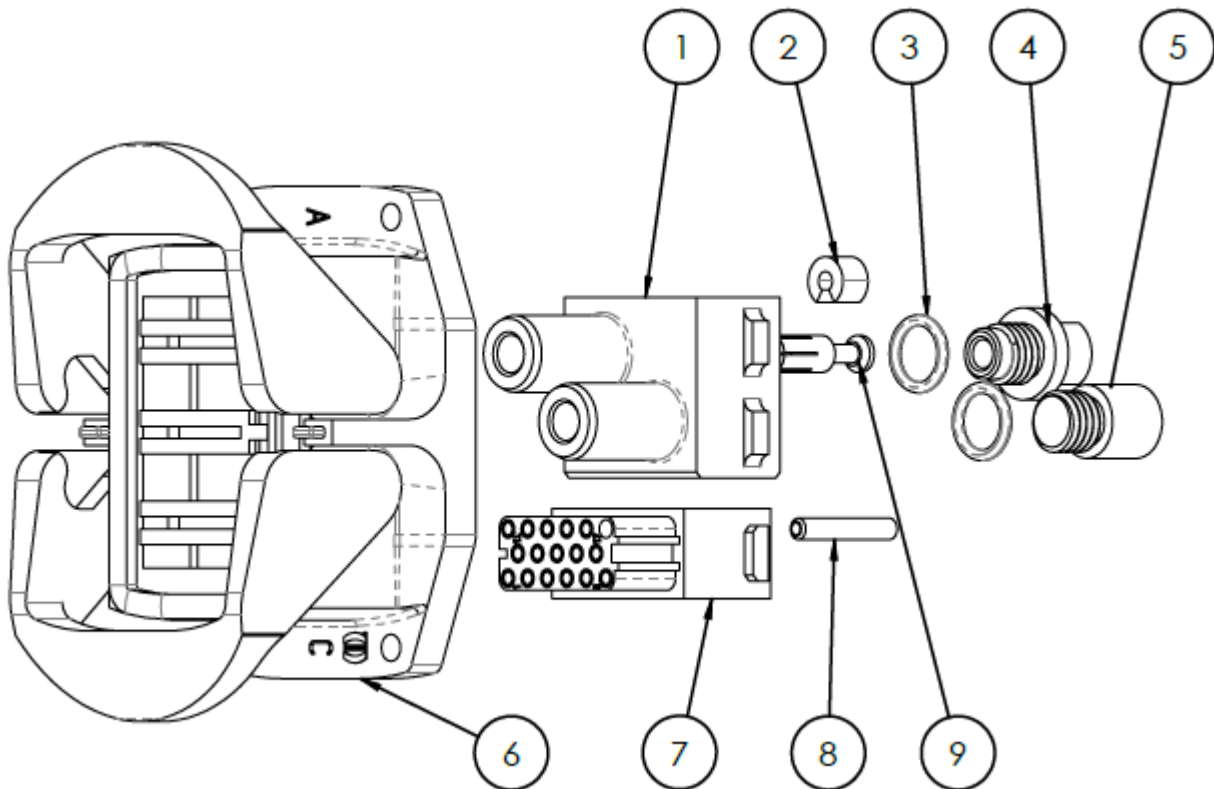


Table 10 - SINGLE FEMALE HV connector module, Mk3, for Treatment Lance component list

ITEM NO.	PART NUMBER	DESCRIPTION	ROOTWAVE/ OFF THE SHELF	QTY.
1	U-PRO-MEC047	PRO HIGH VOLTAGE CONNECTOR DOUBLE FEMALE MODULE MK3	ROOTWAVE	1
2	U-HV_SC001	PRO HV CONNECTOR SHROUD COLLET MK3	ROOTWAVE	1
3	527-9807	RS PRO - SILICONE O-RING, 9.25mm BORE, 1/2IN OUTER DIAMETER	OFF THE SHELF	2
4	U-PRO-MEC049	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK3	ROOTWAVE	1
5	U-PRO-MEC050	PRO TREATMENT LANCE SHROUD BLANK INSERT MK3	ROOTWAVE	1
6	19410060301	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1

ITEM NO.	PART NUMBER	DESCRIPTION	ROOTWAVE/ OFF THE SHELF	QTY.
7	9140173101	HARTING - HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, FEMALE	OFF THE SHELF	1
8	9150006204	HARTING - CRIMP CONTACT, HAN CONTACTS FEMALE, 1 WAY, RATED AT 10A, HAN CD, HAN COM, HAN D, HAN DD, HAN DDD, HAN Q	OFF THE SHELF	15
9	9320006204	HARTING - HAN 40A 830V FEMALE CRIMP	OFF THE SHELF	1

Mk2 treatment cable connectors

Figure 19 - Double MALE HV connector module, Mk2, for treatment cable component diagram

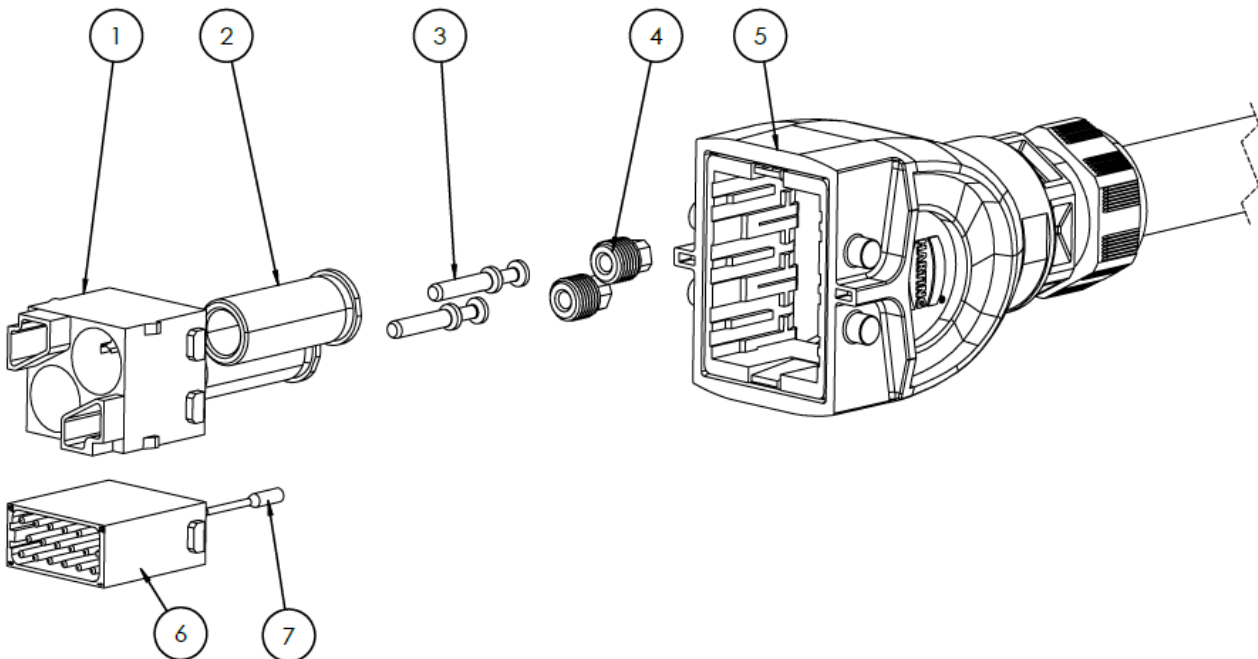


Table 11 -Double MALE HV connector module, Mk2, for treatment cable component list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	9140023001	HARTING - HAN-MODULAR HEAVY DUTY POWER CONNECTOR MODULE, 2 CONTACTS, 10A, MALE	OFF THE SHELF	1

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
2	U-HV_MS001	PRO TREATMENT LANCE MALE HV PLUG SHROUD MK2	ROOTWAVE	2
3	9320006104	HARTING - HAN C MALE 40A CRIMP CONTACT	OFF THE SHELF	2
4	U-HV_SI001	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK2	ROOTWAVE	2
5	19411060422	HARTING - HAN-ECO TOP ENTRY HEAVY DUTY POWER CONNECTOR HOOD	OFF THE SHELF	1
6	9140173001	HARTING HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, MALE	OFF THE SHELF	1
7	19411060422	HARTING HAN-ECO TOP ENTRY HEAVY DUTY POWER CONNECTOR HOOD	OFF THE SHELF	17

Figure 20 - Double FEMALE HV connector module, Mk2, for treatment return and power module component diagram

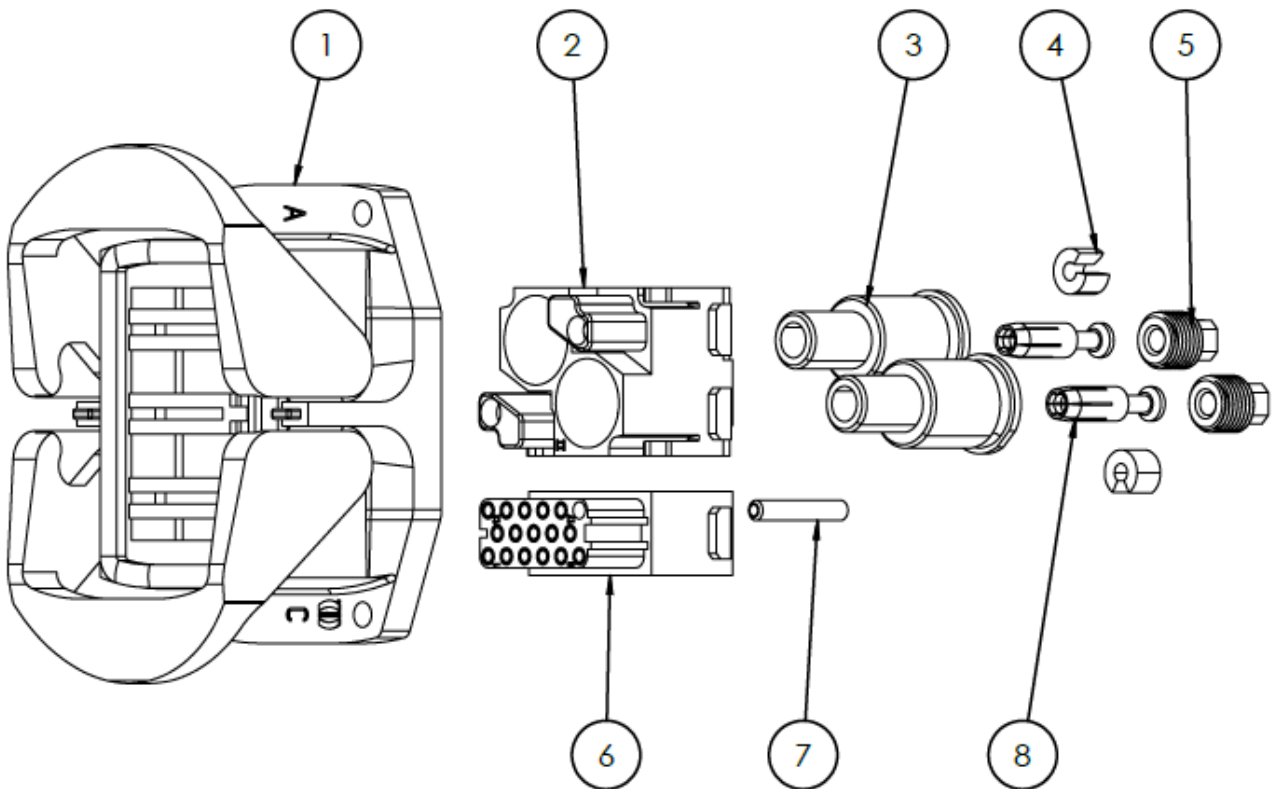


Table 12 - Double MALE HV connector module, Mk2, for treatment return and power module component list

ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	742-2707	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1
2	9140023101	HARTING - HAN-MODULAR STRAIGHT HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1
3	U-HV_FS001	PRO TREATMENT LANCE FEMALE HV SOCKET SHROUD MK2	ROOTWAVE	2
4	U-HV_SC001	PRO HV CONNECTOR SHROUD COLLET MK3	ROOTWAVE	2
5	U-HV_SI001	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK2	ROOTWAVE	2
6	9140173101	HARTING - HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, FEMALE	OFF THE SHELF	1
7	9150006204	HARTING - CRIMP CONTACT, HAN CONTACTS FEMALE, 1 WAY, RATED AT 10A, HAN CD, HAN COM, HAN D, HAN DD, HAN DDD, HAN Q	OFF THE SHELF	17
8	9320006204	HARTING - HAN 40A 830V FEMALE CRIMP	OFF THE SHELF	1

Figure 21 - SINGLE FEMALE HV connector module, Mk2, for Treatment Lance component diagram

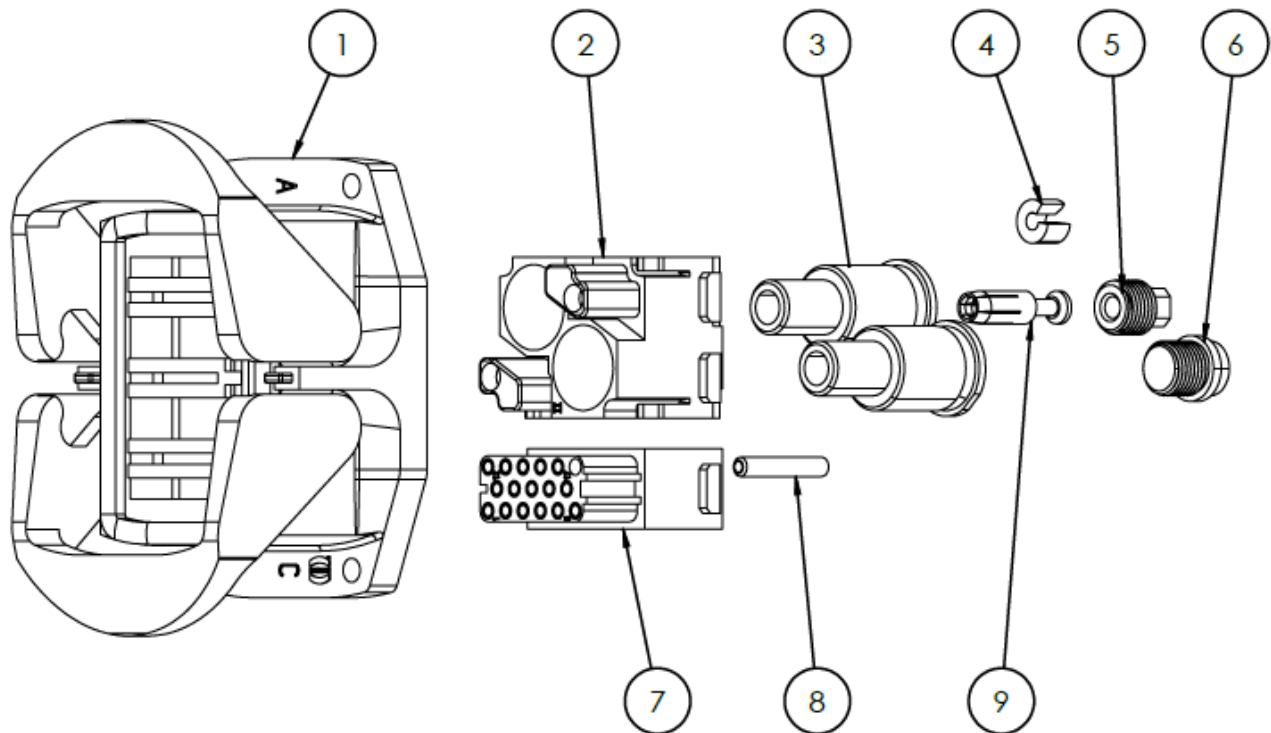


Table 13 - SINGLE FEMALE HV connector module, Mk2, for Treatment Lance component list

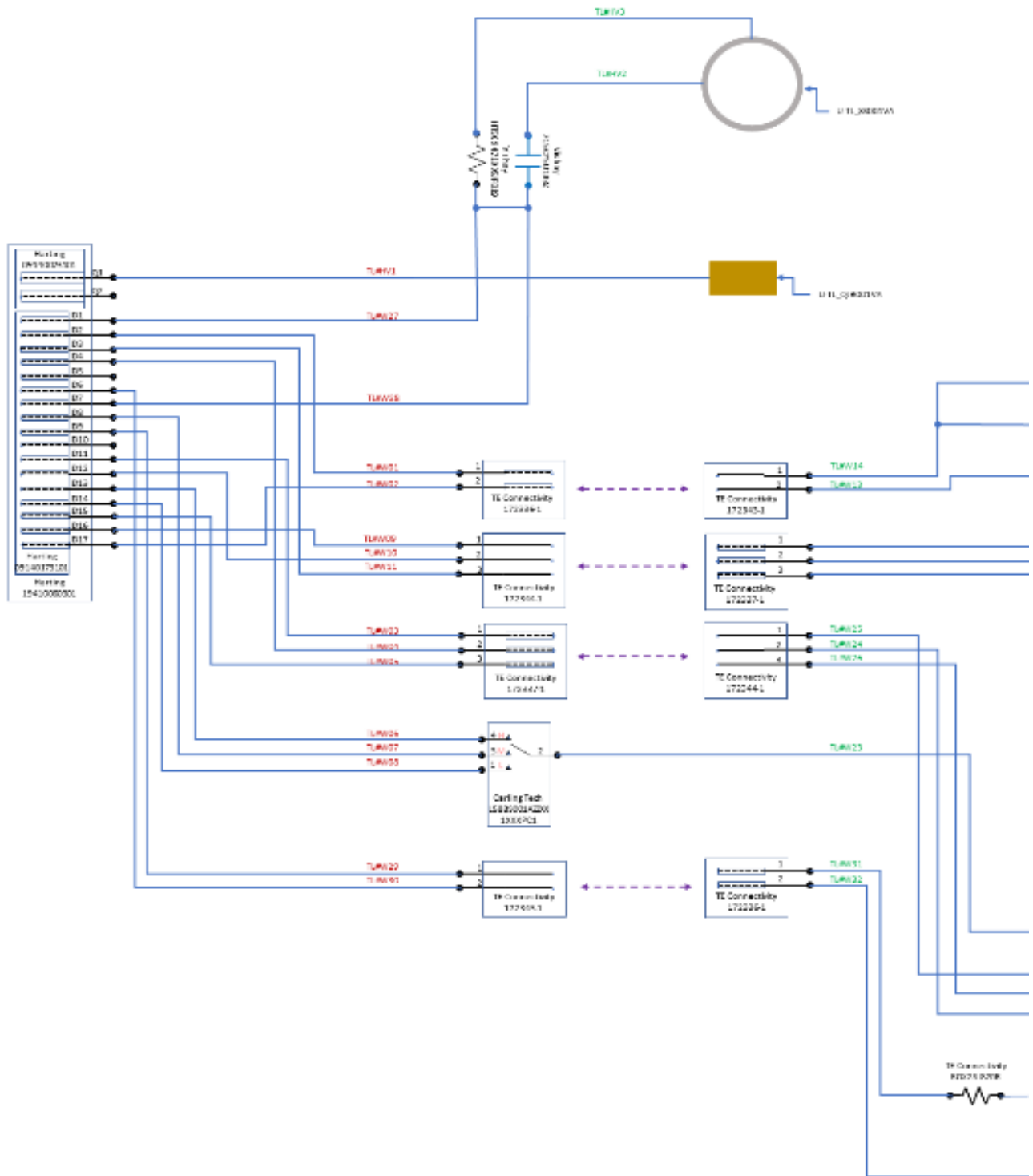
ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
1	742-2707	HARTING - HAN-ECO HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1
2	9140023101	HARTING - HAN-MODULAR STRAIGHT HEAVY DUTY POWER CONNECTOR HOUSING	OFF THE SHELF	1
3	U-HV_FS001	PRO TREATMENT LANCE FEMALE HV SOCKET SHROUD MK2	ROOTWAVE	2
4	U-HV_SC001	PRO HV CONNECTOR SHROUD COLLET MK3	ROOTWAVE	1
5	U-HV_SI001	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT MK2	ROOTWAVE	1
6	U-HV_SI002	PRO HIGH VOLTAGE CONNECTOR SHROUD INSERT BLIND MK2	ROOTWAVE	1
7	9140173101	HARTING - HAN-MODULAR CONTACT INSERT, 17 CONTACTS, 10A, FEMALE	OFF THE SHELF	1

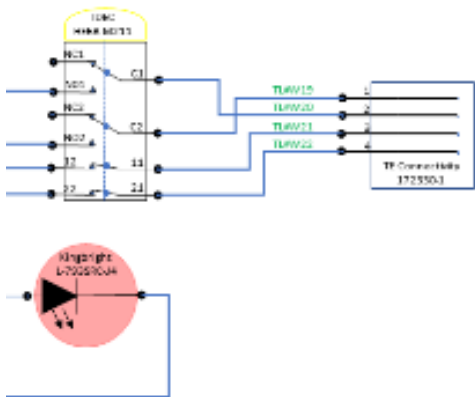
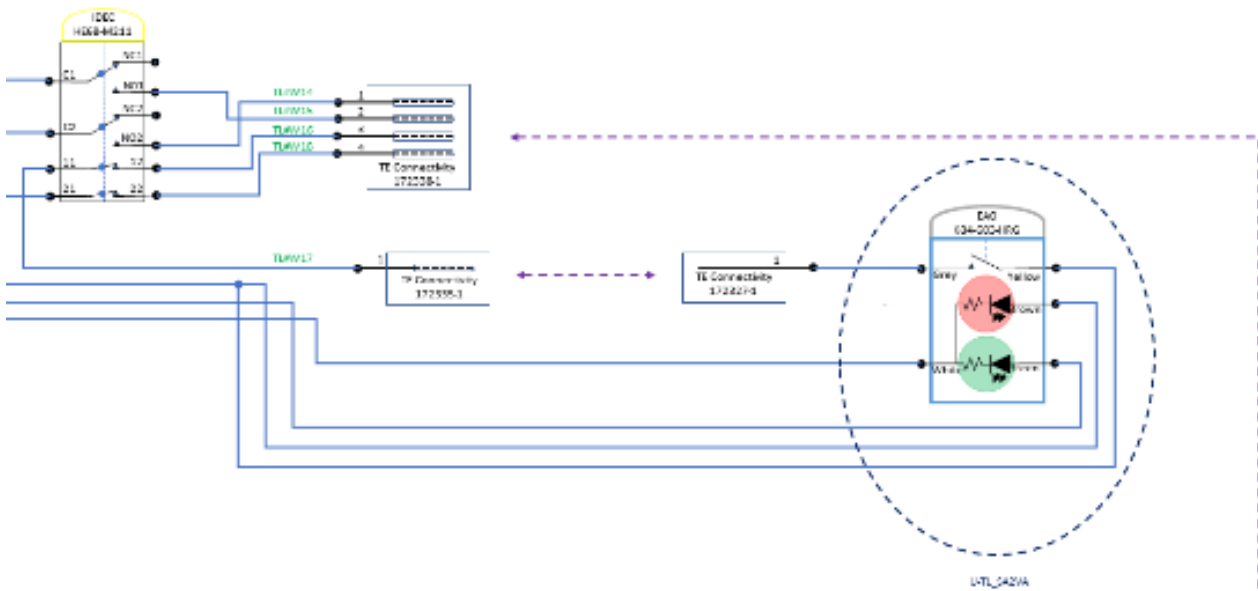
ITEM NO.	PART NUMBER	DESCRIPTION	SOURCE	QTY.
8	9150006204	HARTING - CRIMP CONTACT, HAN CONTACTS FEMALE, 1 WAY, RATED AT 10A, HAN CD, HAN COM, HAN D, HAN DD, HAN DDD, HAN Q	OFF THE SHELF	15
9	9320006204	HARTING - HAN 40A 830V FEMALE CRIMP	OFF THE SHELF	1

Electrical schematics

Treatment Lance

Figure 22 - Treatment Lance electrical schematic

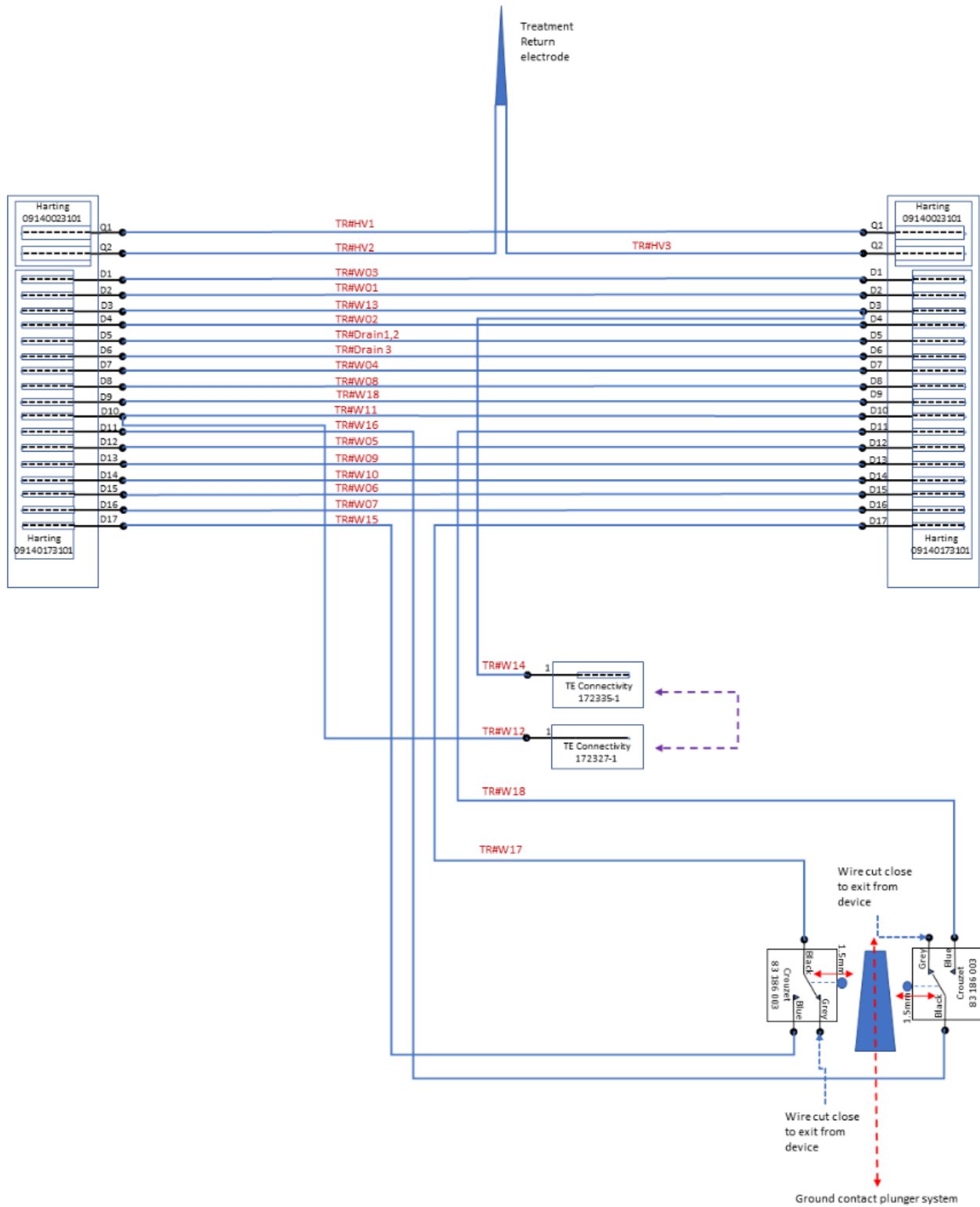




Extract from RW-2-PRO-230_TL_VE

Treatment Return

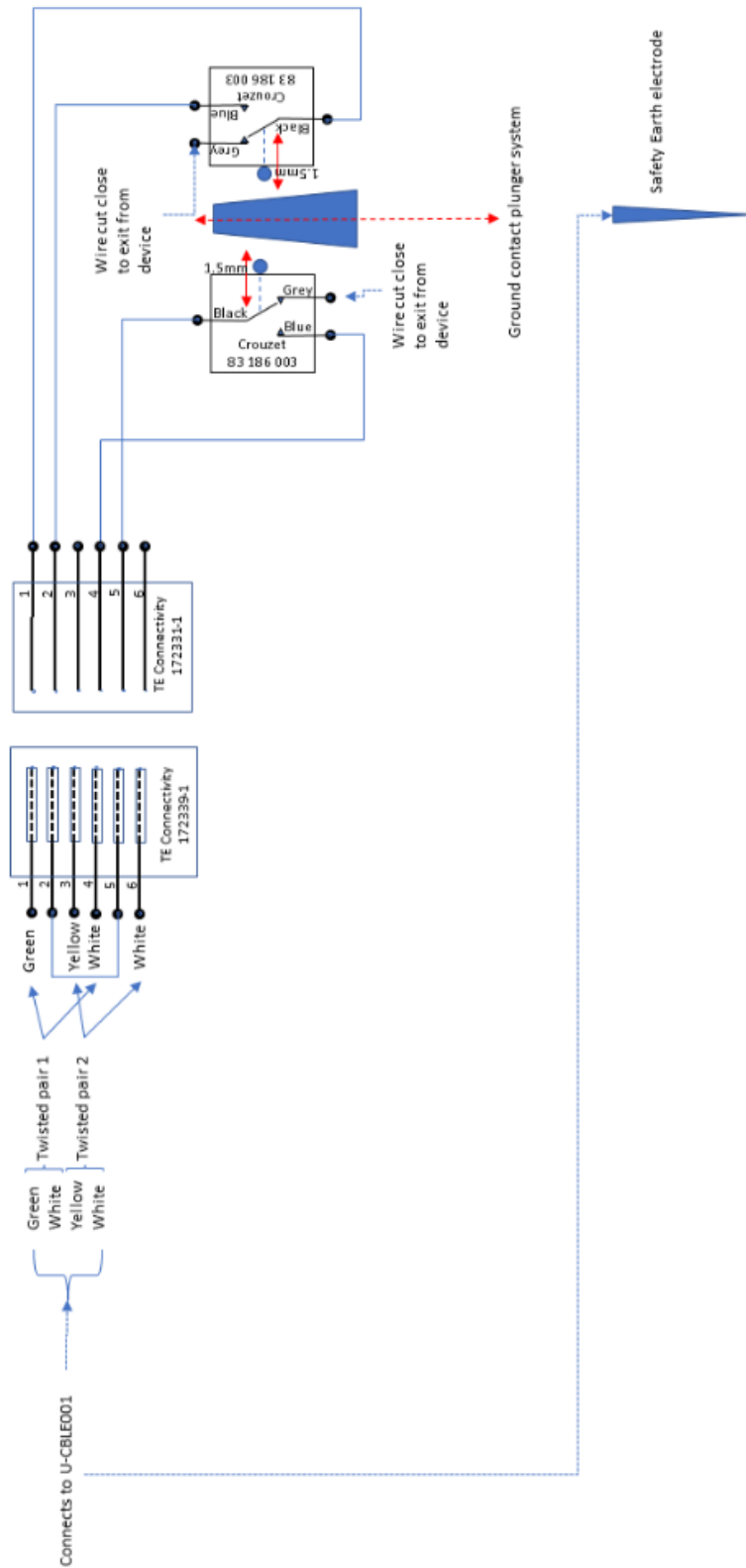
Figure 23 - Treatment Return electrical schematic



Extract from RW-2-PRO-230_TR_VF

Safety Earth

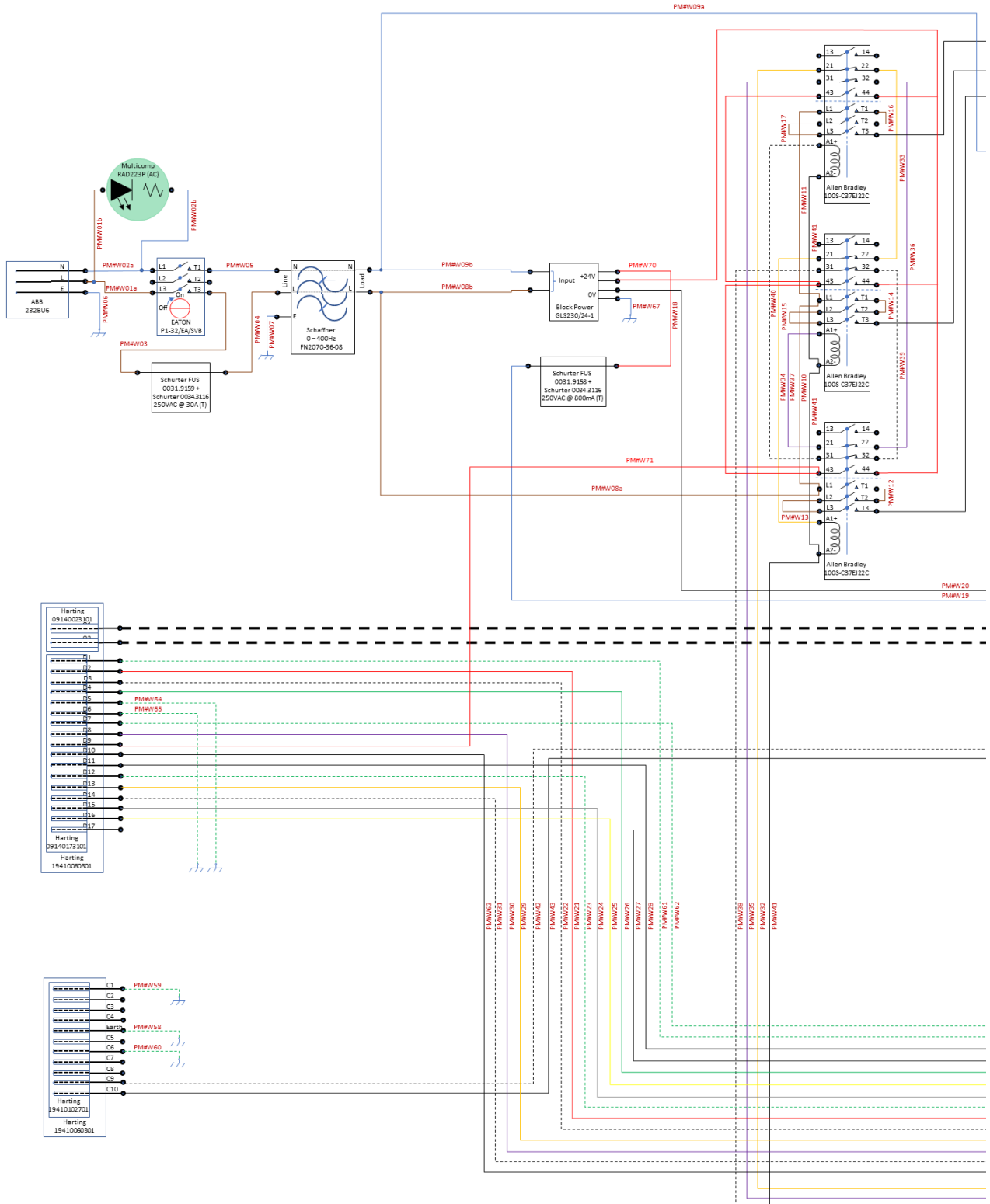
Figure 24 - Safety Earth electrical schematic

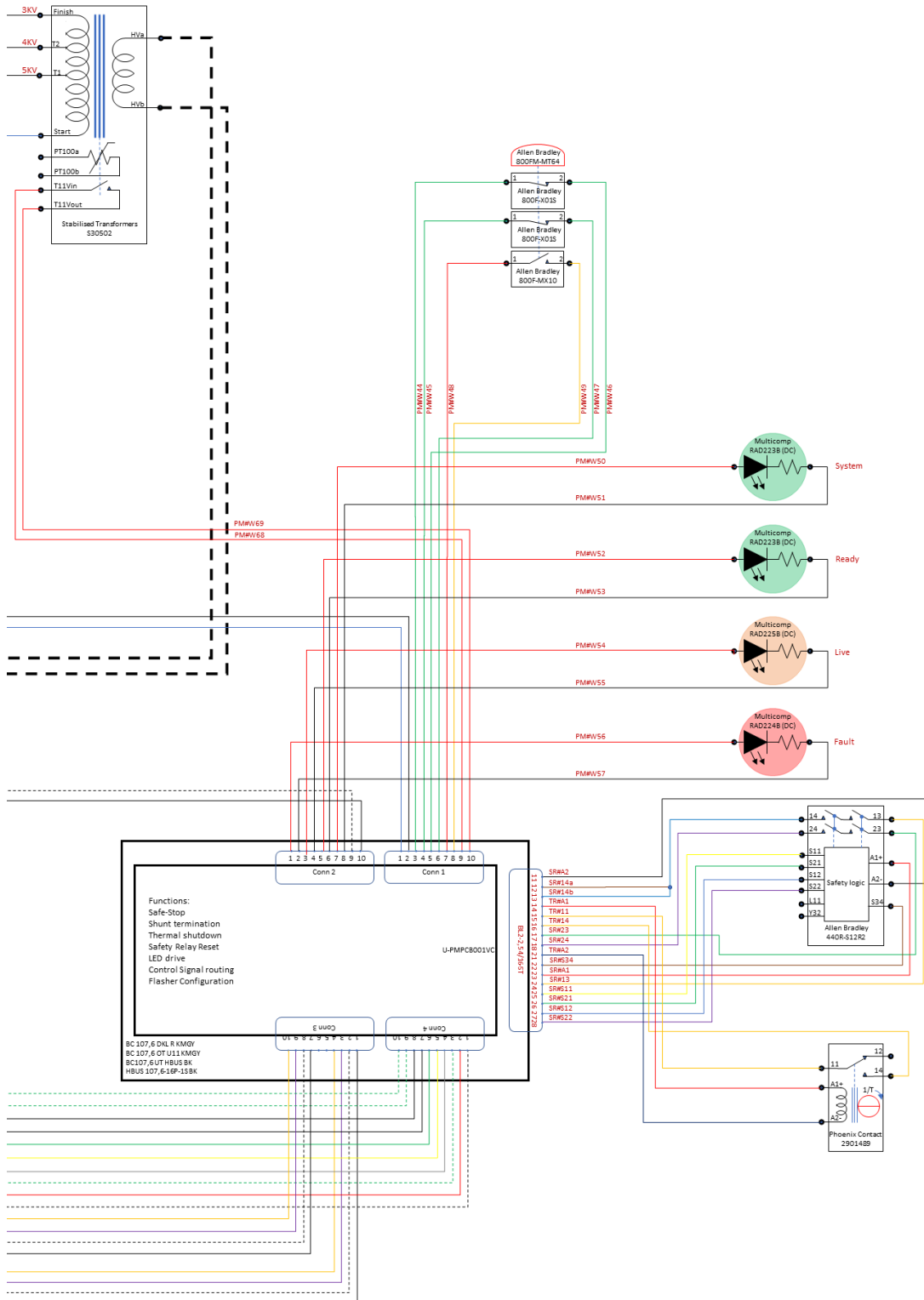


Extract from RW-2-PRO-230_SE_VE

Power Module

Figure 25 - Power Module electrical schematic





Extract from RW-2-PRO_PM_VC

Front Panel wiring schedule

Table 14 - Power Module front panel wiring schedule

Wire reference	Wire type (Alpha Wire)	Colour	Length (mm)	Termination end A (Manufacturer - part number)	Termination end B (Manufacturer - part number)	End A start	End B termination
PM#W01a	6713	Brown	220	TE Connectivity - 32589	TE Connectivity - 131332	Inlet (Live)	Isolator (L1)
PM#W01b	6719	Brown	220	TE Connectivity - 130516		Green 240V LED (X1)	
PM#W02a	6719	Blue	260	TE Connectivity - 32589	TE Connectivity - 131332	Inlet (Neutral)	Isolator (L3)
PM#W02b	6713	Blue	260	TE Connectivity - 130516		Green 240V LED (X2)	
PM#W03	6719	Brown	155	TE Connectivity - 32589	TE Connectivity - 640907-1	Isolator (T1)	32A Fuse (Line)
PM#W04	6719	Brown	100	TE Connectivity - 640907-1	TE Connectivity - 320568	32A Fuse (Load)	Filter (Line P)
PM#W05	6719	Blue	220	TE Connectivity - 32589	TE Connectivity - 320568	Isolator (T3)	Filter (Line N)
PM#W06	6719	Green/Yellow	220	TE Connectivity - 131332	TE Connectivity - 320576	Inlet (Earth)	Chassis (Stud)
PM#W07	6719	Green/Yellow	150	TE Connectivity - 320568	TE Connectivity - 320576	Filter (PE)	Chassis (Stud)
PM#W08a	6719	Brown	220	TE Connectivity - 320568	TE Connectivity - 131332	Filter (Load +ve)	PM#H (L1 - top)
PM#W08b	6713	Brown	220		Pheonix Contact - 3203040		Block (input)
PM#W09a	6719	Blue	80	TE Connectivity - 320568	RS PRO - 534-941	Filter (Load -ve)	
PM#W09b	6713	Blue	220		Pheonix Contact - 3203040		Block (input)
PM#W10	6719	Brown	100	TE Connectivity - 131332	TE Connectivity - 131332	PM#H (L1 - bottom)	PM#M (L1 - bottom)
PM#W11	6719	Brown	100	TE Connectivity - 131332	TE Connectivity - 131332	PM#M (L1 - top)	PM#H (L1 - top)
PM#W12	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#H (T1 - top)	PM#H (T2 - top)
PM#W13	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#H (L2 - top)	PM#H (L3 - top)
PM#W14	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#M (T1 - top)	PM#M (T2 - top)
PM#W15	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#M (L2 - top)	PM#M (L3 - top)
PM#W16	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#L (T1 - top)	PM#L (T2 - top)
PM#W17	6719	Brown	80	TE Connectivity - 131332	TE Connectivity - 131332	PM#L (L2 - top)	PM#L (L3 - top)
PM#W18	6713	Red	260	Pheonix Contact - 3203040	TE Connectivity - 640903-1	Block (ouput +)	1A Fuse (Line)
PM#W19	6713	Red	430	TE Connectivity - 640903-1	Pheonix Contact - 3203040	1A Fuse (Load)	CONN (1 - 1)
PM#W20	6713	Black	280	Pheonix Contact - 3203040	Pheonix Contact - 3203040	Block (ouput -)	CONN (1 - 2)
PM#W21	6713	Red	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (2)	CONN (4 - 2)
PM#W22	6713	White	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (3)	CONN (4 - 1)
PM#W23	6713	Green/Yellow	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (12)	CONN (4 - 3)
PM#W24	6713	Grey	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (15)	CONN (4 - 4)
PM#W25	6713	Yellow	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (16)	CONN (4 - 5)
PM#W26	6713	Green	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (4)	CONN (4 - 6)
PM#W27	6713	Black	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (17)	CONN (4 - 8)
PM#W28	6713	Black	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (11)	CONN (4 - 7)
PM#W29	6713	Orange	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (13)	CONN (3 - 10)
PM#W30	6713	Purple	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (8)	CONN (3 - 9)
PM#W31	6713	White	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (14)	CONN (3 - 8)
PM#W32	6713	Orange	380	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (3 - 4)	PM#L (NC - 21)
PM#W33	6713	Orange	80	TE Connectivity - 130516	TE Connectivity - 130516	PM#L (NC - 22)	PM#M (NC - 22)
PM#W34	6713	Orange	185	TE Connectivity - 130516	TE Connectivity - 130516	PM#M (NC - 21)	PM#H (+24V)
PM#W35	6713	Purple	360	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (3 - 3)	PM#L (NC - 31)
PM#W36	6713	Purple	155	TE Connectivity - 130516	TE Connectivity - 130516	PM#L (NC - 32)	PM#H (NC - 22)

Wire reference	Wire type (Alpha Wire)	Colour	Length (mm)	Termination end A (Manufacturer - part number)	Termination end B (Manufacturer - part number)	End A start	End B termination
PM#W37	6713	Purple	200	TE Connectivity - 130516	TE Connectivity - 130516	PM#H (NC - 21)	PM#M (+24V)
PM#W38	6713	White	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (3 - 2)	PM#M (NC - 31)
PM#W39	6713	White	80	TE Connectivity - 130516	TE Connectivity - 130516	PM#M (NC - 32)	PM#H (NC - 32)
PM#W40	6713	White	215	TE Connectivity - 130516	TE Connectivity - 130516	PM#H (NC - 31)	PM#L (+24V)
PM#W41	6713	Black	230	1xPheonix Contact - 3203040	TE Connectivity - 130516	CONN (3 - 1)	PM#L (0V)
			80	TE Connectivity - 130516		PM#M (0V)	
			80		TE Connectivity - 130516		PM#H(0)
PM#W42	6713	White	490	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (2 - 9)	Mono(9)
PM#W43	6713	Black	490	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (2 - 10)	Mono(10)
PM#W44	6713	Green	380	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 6)	eStop 1 Con 1
PM#W45	6713	Green	380	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 5)	eStop 2 Con 1
PM#W46	6713	Green	380	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 4)	eStop 1 Con 2
PM#W47	6713	Green	380	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 3)	eStop 2 Con 2
PM#W48	6713	Red	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 7)	eStop Monitor (1)
PM#W49	6713	Orange	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (1 - 8)	eStop Monitor (2)
PM#W50	6713	Red	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 7)	System LED (X1)
PM#W51	6713	Black	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 8)	System LED (X2)
PM#W52	6713	Red	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 5)	Ready LED (X1)
PM#W53	6713	Black	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 6)	Ready LED (X2)
PM#W54	6713	Red	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 4)	Live LED (X1)
PM#W55	6713	Black	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 3)	Live LED (X2)
PM#W56	6713	Red	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 1)	Fault LED (X1)
PM#W57	6713	Black	320	TE Connectivity - 130516	Pheonix Contact - 3203040	CONN (2 - 2)	Fault LED (X2)
PM#W58	6717	Green/Yellow	140	TE Connectivity - 328998	Pheonix Contact - 3200069	Monoblock (Earth)	Chassis (Stud)
PM#W59	6717	Green/Yellow	120	TE Connectivity - 328998	Pheonix Contact - 3200069	Monoblock (1)	Chassis (Stud)
PM#W60	6717	Green/Yellow	120	TE Connectivity - 328998	Pheonix Contact - 3200069	Monoblock (6)	Chassis (Stud)
PM#W61	6713	Green/Yellow	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (1)	CONN (4 - 9)
PM#W62	6713	Green/Yellow	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (7)	CONN (4 - 10)
PM#W63	6713	Black	170	Harting - 09150006204	Pheonix Contact - 3203040	Harting (10)	CONN (3 - 7)
PM#W64	6713	Green/Yellow	100	Harting - 09150006204	TE Connectivity - 320572	Harting (5)	Chassis (Stud)
PM#W65	6713	Green/Yellow	100	Harting - 09150006204	TE Connectivity - 320572	Harting (6)	Chassis (Stud)
PM#W66	Removed from list						
PM#W67	6713	Green/Yellow	320	Pheonix Contact - 3203040	TE Connectivity - 320572	Block (ouput -)	Chassis (Stud)
PM#W68a	6713	Red	220	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (1 - 9)	Transformer T11
PM#W69a	6713	Red	220	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (1 - 10)	Transformer T11
PM#W68b	6713	Red	350	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (1 - 9)	Transformer T11
PM#W69b	6713	Red	350	Pheonix Contact - 3203040	Pheonix Contact - 3203040	CONN (1 - 10)	Transformer T11
PM#W70	6713	Red	150	Pheonix Contact - 3203040	TE Connectivity - 130516	Block (ouput +)	PM#L (14)
			75	TE Connectivity - 130516		PM#L (44)	
			50		TE Connectivity - 130516		PM#M (14)

Wire reference	Wire type (Alpha Wire)	Colour	Length (mm)	Termination end A (Manufacturer - part number)	Termination end B (Manufacturer - part number)	End A start	End B termination
			75	TE Connectivity - 130516	TE Connectivity - 130516	PM#M (44)	PM#H (14)
			50				
			75	TE Connectivity - 130516		PM#H (44)	
PM#W71	6713	Red	320	Harting - 09150006204	TE Connectivity - 130516	Harting (9)	PM#L (13)
			75	TE Connectivity - 130516		PM#L (43)	
			50		TE Connectivity - 130516		PM#M (13)
			75	TE Connectivity - 130516		PM#M (43)	
			50		TE Connectivity - 130516		PM#H (13)
			75	TE Connectivity - 130516		PM#H (43)	
SR#A2	N/A	16 - Black	170	Pheonix Contact -	Pheonix Contact - 3203040	N/A	Safety Relay (A2)
SR#14a		14 - Brown	155		Pheonix Contact - 3201275		Safety Relay (14)
SR#14b		4 - Blue	150				
TR#A1		12 - Red	140		Pheonix Contact - 3203040		Safety Relay (A1)
TR#11		10 - Orange	135		Pheonix Contact - 3203040		Timer Relay (11)
TR#14		8 - Yellow	135		Pheonix Contact - 3203040		Timer Relay (14)
SR#23		6 - Green	165		Pheonix Contact - 3203040		Safety Relay (23)
SR#24		2 - Purple	165		Pheonix Contact - 3203040		Safety Relay (24)
TR#A2		15 - Black	170		Pheonix Contact - 3203040		Timer Relay (A2)
SR#S34		13 - Brown	190		Pheonix Contact - 3203040		Safety Relay (S34)
SR#A1		11 - Red	180		Pheonix Contact - 3203040		Timer Relay (A1)
SR#13		9 - Orange	155		Pheonix Contact - 3203040		Safety Relay (13)
SR#S11		7 - Yellow	180		Pheonix Contact - 3203040		Safety Relay (S11)
SR#S21		5 - Green	195		Pheonix Contact - 3203040		Safety Relay (S21)
SR#S12		3 - Blue	160		Pheonix Contact - 3203040		Safety Relay (S12)
SR#S22		1 - Purple	170		Pheonix Contact - 3203040		Safety Relay (S22)

Extract from Pro_Wiring_Spec_01_RevG

Special tools

Harting pin removal tool	
Harting connector removal tool x 2	
Label printer for tamper evident labels and service by/date stickers	

Disposal

RootWave products must be recycled at a recycling station for electrical and electronic equipment. This helps minimise the impact of electrical and electronic goods on the environment. Speak to your local waste service or your RootWave supplier for more information.



