Data collection unit (DCU)

Maintenance manual with spare parts list

Publication ref TP0018
Issue 2 December 1999
Amendment 1 July 2001
## AMENDMENT RECORD

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HEALTH AND SAFETY AT WORK ACT 1974

REFERENCE: CHAPTER 37, PART 1, SECTION 6

The Company takes every care to ensure that, in accordance with the above Act, their products, as far as is reasonably practical in an industrial environment, are when operated and maintained in accordance with the appropriate manual, safe without risk to health.

NOTE:

Modifications not authorised in writing by the manufacturer, nullify all warranty and other liabilities.

PRODUCT SAFETY

In the interest of safety it is strongly recommended by Avery—Hardoll that the following details receive strict attention.

For the Purpose of Definition, the word PRODUCT applies to any product sold by Avery—Hardoll.

1 The Product is used only with fluids we state as acceptable.
2 The Product must only be coupled/connected to equipment we consider acceptable.
3 The Product must not be misused or handled in any way liable to cause damage.
4 The Product must be inspected for any signs of damage prior to use e.g. cracks, damaged seals etc.
5 The Product must be subjected to a regular maintenance programme, either in accordance with the manual or as agreed with us.
6 Only technically competent personnel should repair or maintain the Product and only parts supplied by Avery—Hardoll may be used.
7 Products covered by warranty may not be modified in any way without prior written permission of Avery—Hardoll.
8 Products not in service, must be stored in a clean area, and should not be subjected to excessive temperature, humidity, sunlight, or strong artificial light. Products should be protected to prevent damage or the ingress of foreign matter.
9 Where applicable, attention should be drawn to dangers resulting from the generation of static electricity in product flow lines. We strongly recommend account is taken of BS5958 parts 1 and 2.
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Chapter 1
TECHNICAL DESCRIPTION

CONTENTS

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1 General Information
2 Technical Description

1 GENERAL INFORMATION

1.1 The DCU (Data Collection Unit) enables information from up to 16 Avery-Hardoll Masterload systems to be collected at a central point for record printing.

1.2 The DCU is located in a safe area i.e. control room, which enables records to be printed economically within an easily administered area. (Refer to Fig. 1.1.).

1.3 Communication between DCU and Masterload is by hardwire RS422.

1.5 Located on the side of the DCU are serial ports for connecting Ticket and Log Printers.

1.6 Each ticket printed is uniquely identified by transaction number, data, time, vehicle/driver reference and compartment number. Each batch is recorded on the log printer to provide a summary of all operations.

1.7 The DCU can also be linked to a computer.
1.8 The DCU computer port is RS232 compatible and also supports a full bus communications to RS485. Operation of the DCU is transparent to the computer system.

1.9 The computer link allows the following information to be read:

- Batch quantity (natural volume).
- Batch quantity (nett volume).
- Batch quantity (weight).
- Batch number.
- Preset quantity remaining.
- Rate of flow.
- Temperature
- Density
- Totaliser.
- Error codes.
- Status.
- Meter ID.
- Driver ID.
- Vehicle ID.
- Compartment
1.10 There are two methods of linking computer - DCU - Masterload. Fig. 1.3. shows a typical "star" configuration where each DCU is connected to a separate RS232 port on the computer. This configuration is limited by the number of RS232 ports available.

Fig 1.3 TYPICAL STAR CONFIGURATION

Fig 1.4 TYPICAL DATA BUS CONFIGURATION
1.11 Fig. 1.4. shows a typical “data bus” connection using the RS485 port. Each DCU is connected in series, up to a maximum of 31 units.

1.12 The computer port on the DCU may be connected to any computer system that will support the standard protocol. Details of this link are available on application to Avery-Hardoll.

1.13 The DCU (whether in stand alone or computer mode) can be connected in the following configuration:
- Log printer only
- Ticket printer only
- Log and Ticket printer
- No printers

1.14 Power supply to the DCU can be either 240-220V or 110VAC or alternatively 12/24VDC.

2. TECHNICAL DESCRIPTION

2.1 The DCU comprises a steel box (earlier versions are moulded plastic) fitted with a hinged, lockable door. Contained within the box, mounted on a baseplate, is an Electronics Board Assembly and a hardwired RS422 board. A power cable and ribbon cable interconnect the two boards.

2.2 The baseplate is secured to the box on four mounting brackets. The two boards are located on the baseplate by studs fitted with spacers and secured by nuts and washers. The four corner studs are M6 size and the remaining eight studs are M4 size.

2.3 A removable coverplate secured to four spacers mounted on the Electronics Board Assembly, gives access, when removed, to connectors, terminal blocks and electrical components.

2.4 The electrical power to the DCU, the data communications bus and the data serial links are connected through the connector bracket assembly which may be removed as a complete unit from the side of the box. Refer to Fig.2.2.

2.5 The electrical power supply to the unit can be 240-220 or 110V AC, fed through a fused mains socket, filter and voltage selection switch mounted on the connector bracket assembly. Alternatively the supply can be 12/24V DC, fed through socket terminals on connector blocks on the Electronics Board Assembly.
2.6. ELECTRONICS BOARD ASSEMBLY

2.7 The Electronics Board Assembly provides two way data communication between Masterload, a computer and/or printers. Communication with Masterload is hardwired via the RS422 board, the computer by RS485 communications bus or RS232C serial link and the printers by RS232C serial links.

2.8 A voltage regulator on the Electronics Board provides 5V DC supply to all logic circuitry and devices within the DCU. Electrical supply to the board is via terminal blocks TB1 and TB2. AC supply is fed from TB2 via a toroidal transformer and diode rectifier to the regulator; DC supply is fed from TB1 via a 3A fuse and diodes to the regulator.

2.9 A sixteen character Liquid Crystal Display (LCD) provides continuous readout of date and time which are set by operation of switch SW1 on the Electronics Board. Switch SW1 is also used to call up and modify flag values displayed on the LCD.

2.10 A second switch SW2 is used to configure the Electronics Board for the number of printers required and the type of computer connection i.e. RS485 bus or RS232 serial link.
2.11 The Electronics Board stores information for onward transmission when the computer or printers are busy. The Electronics Board is continually updated with the latest information from any Masterload and stores a complete copy of all Masterload primary variables i.e. tote, batch.

2.17 CONNECTOR BRACKET ASSEMBLY

2.18 The connector bracket assembly is secured to the side of the box by eight pan headed screws. The bracket comprises a metal plate with machined apertures for mounting power supply and communication sockets.

2.19 A combined mains supply socket and filter (with a built in fuse housing) is secured by two screws, nuts and washers to the bracket. A total of five wires are connected to the filter output (two connected to the voltage selection switch, two connected to TB2 on the Electronics Board Assembly and one secured to the coverplate mounting screw to earth the cover).

2.20 The voltage selection switch is a two position, double-pole changeover switch, secured by two screws and washers to the bracket. The switch can be set in either the 240V or 120V position depending upon the incoming supply. The two output wires from the switch are connected to terminal block TB2.
2.21 Two socket terminals (Red + and Black -) are mounted on the bracket to allow connection of 12/24V DC supply, a wire from each terminal is connected to terminal block TB1.

2.22 Four communication sockets are secured by screw lock assemblies to the bracket. Three are twenty-five way 'D' type sockets providing connection to the Ticket and Log printers and the RS232 serial computer link. The fourth is a nine way 'D' type socket and provides connection for the RS485 bus connection. The wires from all sockets are connected to plug PL1 which, in turn, connects to socket SK1 on the Electronics Board Assembly.

2.23 All wiring is secured along its length by cable ties to form easy to handle harnesses.

2.24 ELECTRONICS BOARD SWITCHES

2.25 SW1 is a push-button type switch used to alter information displayed on the Liquid Crystal Display. Push and release will move a cursor across the L.C.D, push and hold will enable parameters to be reset i.e. Date, Time.

2.26 Switch SW2 is a four way, triple in-line switch. Setting up each of the four switches to the ON or OFF position will configure the DCU to the required number of printers and type of communication link to the computer.
Chapter 2

SPECIFICATION

1. DCU DIMENSIONS:

<table>
<thead>
<tr>
<th></th>
<th>Steel BEMY 130</th>
<th>Plastic BEMY 130–16H (obsolete)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth: (including mounting boxes)</td>
<td>150mm</td>
<td>158mm</td>
</tr>
<tr>
<td>Width:</td>
<td>300mm</td>
<td>355mm</td>
</tr>
<tr>
<td>Height: (excluding cable glands)</td>
<td>400mm</td>
<td>455mm</td>
</tr>
</tbody>
</table>

2. ELECTRICAL:

Power Supply: 240-220/110VAC or 12/24VDC - 3 core cable, 3 amp rated.
Mains (AC) Fuse: 2A in Mains/Filter.
12/24V DC Fuse: 3A quick blow fitted on Electronics Board.

3. OPERATING TEMPERATURE RANGE:

Operating: 0°C to +50°C (+32°F to +122°F).
Storage: -20°C to +60°C (-4°F to +140°F).

4. OPERATING ENVIRONMENT:

Office based, non-hazardous.
Maximum relative humidity: 93%, non-condensing.

5. COMMUNICATION LINKS:

Masterload: 4 wire shielded twisted pairs, with an overall screen.
Ticket Printer: RS232 serial link, 1200 baud.
Log Printer: RS232 serial link, 1200 baud
Personal Computer: 1200 to 9600 baud selectable between RS232 or RS485

6. STANDARDS:

The system is interference tested in accordance with the National Weights and Measures Laboratory Specification No 320.

7. CABLE SPECIFICATION:

Standard Instrumentation Cable (BS5308 Part 2 Type 2 Pairs Overall Screened 0.5mm² (16/0.2mm) is the minimum cable specification. Suitable gland to comply with regulations must be fitted in the Hazardous Area.
Chapter 3
INSTALLATION & OPERATION

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1 Receipt
2 General Information
3 DCU - Installation
4 Cable Connections
5 Data Cable general information
6 Cable Installation
7 Cable Connections
8 Setting Up
9 Commissioning
10 Initial Power Up
11 Delivery Sequence
12 System Control
13 DCU Set Up Example
14 Printer Set Up Example

1 RECEIPT

WARNING

WORK MUST ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL.

ENSURE THAT ALL REGULATIONS REGARDING THE USE OF EQUIPMENT IN A ZONE 1 HAZARDOUS AREA ARE COMPLIED WITH.

ELECTRO-STATIC SENSITIVE DEVICES.

• This equipment contains Electro-static sensitive devices. The precautions specified in BS EN 1000015-1 must be obeyed.

• No Arc welding is to be carried out after this equipment has been fitted. Welding can generate sufficient voltage within the equipment to severely damage the components.

• An equipment manual must be available before installation commences.

• Wiring to be independently checked before power is applied to the equipment.

• Voltages higher than the equipment specification must not be applied to the equipment.

1.1 The DCU and any associated parts ordered will be delivered in suitably packed containers, any signs of damage to the containers must be reported to the carrier.

1.2 To avoid damage, particularly to electronic components, all items are to be handled with care at all times. Any deficiencies or damage must be reported to Avery—Hardoll immediately.
1.3 The equipment required for installation comprises part or all of the following:

- DCU completely assembled in box.
- 4 core twisted pair screened cable.
- Power cable complete with three pin socket, or 12/24V two wire cable.
- Printers (not Avery–Hardoll manufacture).
- Computer (not Avery–Hardoll manufacture).
- RS232 serial link cables for printers (if required).
- RS232 or RS485 serial link/bus cable for computer (if required).

2 DCU GENERAL INFORMATION

2.1 Because of the differing designs in Control Room layout, it is beyond the scope of this manual to provide precise details of individual installation.

2.2 The installation information given out lines the general principles for installing DCU within a control room.

2.3 The power supply to the unit should be taken from a 'clean' electrical supply and connected using standard electrical practices.

2.4 A HAZARDOUS AREA is defined as an area where flammable vapour may occur as defined in BS5345 part 2 1983.

3 DCU INSTALLATION

3.1 The DCU MUST NOT be mounted in a HAZARDOUS AREA.

3.2 The unit is designed to be mounted vertically or horizontally in a convenient position within the control room. The position and method of mounting must be such as to:

- Minimise vibration.
- Be mounted flat to prevent distortion.
- Allow sufficient space for the unit door to open fully and allow room for cables (Fig 3.1 refers).
- Be mounted in a position not hazardous to control room personnel.

3.3 The unit box is moulded with four through holes allowing fitting of mounting bolts. The box may be secured directly to a vertical surface or bracket using normal methods of fastening. If required, suitable resilient mounts may be used for mounting.
FIG 3.1 TYPICAL DCU - INSTALLATION DIMENSIONS

Dimensions in millimetres
(Plastic version in brackets)
4 CABLE SPECIFICATION

4.1 Standard Instrumentation Cable (BS5308 Part 2 Type 2 Pairs Overall Screened 0.5mm² (16/0.2mm) is the minimum cable specification. Suitable gland to comply with regulations must be fitted in the Hazardous Area.

5 DATA CABLE GENERAL INFORMATION

5.1 The DCU Hardwired requires 4 core twisted pair twisted screened cable.

5.2 This cable is a standard type available from many sources, max length is 1km.

6 CABLE INSTALLATION

WARNING

WHEN CONNECTING TO MASTERLOAD ENSURE THAT ALL REGULATIONS REGARDING THE USE OF EQUIPMENT IN A ZONE 1 HAZARDOUS AREA ARE COMPLIED WITH.

BEFORE WIRING UP THE CABLE ENSURE POWER SUPPLIES TO THE AUTOMATION SYSTEM UNIT ARE ISOLATED.

6.1 Determine cable run, and allow 600mm each end for termination. The system design allows for multiple Masterloads to be connected with suitable Junction Boxes.

6.2 Route cable.

6.3 Strip back outer insulation to within 20mm of cable gland entry.

6.4 Terminate the wires at each terminal block. Do not connect the outer screen as this will normally be terminated at the Masterload equipment end. See Fig 3.2.

FIG 3.2 CABLE CONNECTIONS
7 CABLE CONNECTIONS

7.1 Mains supply (AC) connection to the DCU is by conventional plug, socket and wiring. The connection should be made to a "clean" mains supply free of surges caused by machinery starting etc.

7.2 12/24V DC supply connection to the DCU is by two core wiring to socket terminals (Red +ve, Black 0V) mounted on the Connector Bracket Assembly (refer to fig. 2.2.).

7.3 Serial links and data bus connections are made by ‘D’ type plugs and sockets and multicore wiring. Table 3.1 below gives details of pin connections.

<table>
<thead>
<tr>
<th>CABLE No.</th>
<th>CONNECTED DEVICE</th>
<th>DCU CONNECTION PIN</th>
<th>EXTERNAL DEVICE CONNECTION PIN</th>
<th>PIN FUNCTION AT DCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PC RS232 25 WAY 'D' TYPE</td>
<td>2</td>
<td>3</td>
<td>TX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>RX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>PC RS232 9 WAY 'D' TYPE</td>
<td>2</td>
<td>2</td>
<td>TX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>RX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>PC RS485</td>
<td>8</td>
<td>AS REQUIRED BY COMPUTER</td>
<td>DATA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>DATA</td>
</tr>
<tr>
<td>4</td>
<td>PRINTER LOG OR TICKET</td>
<td>2</td>
<td>3</td>
<td>TX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>11</td>
<td>BUSY</td>
</tr>
</tbody>
</table>

1 TO ‘SCREEN’       1 TO ‘SCREEN’

| TABLE 3.1 CABLE CONNECTIONS |
8 SETTING UP

8.1 On completion of installation the initial setting up of the DCU must be carried out.

8.2 Switch power OFF, open door of DCU and check that all internal terminal connections are tight and all interconnecting cables between boards are securely in place.

8.3 If mains supply is being used check that the voltage selection switch is in the correct position for either 240V or 120V.

8.4 Connect the printer and computer links to their appropriate 'D' type sockets ensuring that the two securing screws on each connector are finger tight.

8.5 Connect each comms cable to the relevant Masterload (ensure that DCU Tx goes to Masterload Rx). Masterloads should always be connected from Tx 1 onward (i.e. from the Left Hand side).

<table>
<thead>
<tr>
<th>DCU</th>
<th>M'LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>RX</td>
</tr>
<tr>
<td>TX</td>
<td>RX</td>
</tr>
<tr>
<td>RX</td>
<td>TX</td>
</tr>
<tr>
<td>RX</td>
<td>TX</td>
</tr>
</tbody>
</table>

TABLE 3.2 DCU - Masterload connections

NOTE:

A DCU software flag must also be set up to match the number of Masterloads connected (see Section 13 and Table 3.3.

8.6 Switch power supply ON and check that the regulator LED mounted on the Electronics Board is illuminated and that the Liquid Crystal Display shows a row of sixteen figures.

9 COMMISSIONING

9.1 Mounted on the Electronics Board are two switches to customise DCU to the installed system:

SWITCH SW1 - sets the date/time displayed on Liquid Crystal Display.
- also used to set DCU software to correct configuration.

SWITCH SW2 - set the inputs to the Electronics Board for the equipment connected.

Position 2.1 ON Ticket Printer connected.
Position 2.2 ON Log Printer connected.
Position 2.3 ON RS232
OFF RS485
Position 2.4 ON RS232 - CTS (clear to send) connected.
OFF RS232 - CTS not connected or RS485 - connected.
9.2 Set Switch SW2 to match system requirements. Refer to Fig 3.2 above for switch location.

9.3 Set the DATE / TIME on the Liquid Crystal Display by using Set-up Switch SW1. This requires Flags 01 - 06 to be set up as described in Section 13 of this Chapter.

9.4 System configuration may also be changed by operating Switch SW1 to set Flag values, an example of which is given in Section 13 using Table 3.3. Certain modes require power down to implement changes.

9.5 On completion of switch and Flag setting, close the unit door and secure with locking key.

10 INITIAL POWER UP

10.1 The DCU acts as a buffer between Masterload and the rest of the system. The DCU is updated with the latest information from any connected Masterload. Commands from the system will be transmitted to the appropriate Masterload.

10.2 The unit will always maintain up to date Masterload status information for onward transmission, reducing the response time to any computer requests or print outs.

10.3 On power up the unit can command a print out on the log printer of all Masterload flag settings (this can be deselected by using SW1 to alter the value of Flag 12. Refer to Table 3.3).
11 DELIVERY SEQUENCE

11.1 With Masterload in computer (remote) control mode, the delivery sequence starts when the operator enters the following information (as applicable) on Masterload:

- Vehicle ID number
- Driver ID number
- Load number (if required)
- Compartment (Pot) number
- Preset value
- Run push-button pressed.

11.2 At each stage, Masterload sends a request via the DCU to the computer, an acknowledgement is in turn sent back to Masterload which then proceeds to the next stage.

11.3 Masterload finally sends a start delivery request. After performing any necessary validation checks the start delivery command is sent to the Masterload. Masterload will then send Start Pump and Open Preset Valve commands.

11.4 At the end of a delivery, initiated by either the end of Preset or the stop button being pressed, Masterload sends a "delivery amount acceptance" request. The system will reply with a "delivery accepted" message. Masterload then returns to "enter ID" or "idle" mode.

12 SYSTEM CONTROL

12.1 The computer can send stop/start commands via the DCU to a Masterload system to either stop or pause a delivery. When a stop command is received by Masterload it will stop the pump, close the preset valve and wait* for either a start command to continue delivery, or another stop command to extend the pause in delivery period. If neither command is received, Masterload will assume transaction completed and initiate an end of delivery sequence regardless of original quantity required.

* The "pause" time is selectable using Flag 75 in Masterload software. Refer to Masterload manual for further information.

12.2 If the DCU suffers power loss during operation, the printers will stop (no data received from the DCU) and the Masterloads will finish a current delivery, any new transactions will not be started. All data waiting to be printed will be lost. However, to ensure a transaction record is not lost, each Masterload holds the copy of its last tote until told by the DCU that a log print has been completed. The log print is then used to calculate any missed transactions. Each transaction number is kept in the non-volatile part of the DCU Real Time Clock chip. This number is incremented whenever a transaction is completed, hence, if a transaction is 'lost' because it was not printed before a power failure, the transaction number on next power up will indicate the number of lost transactions.

12.3 If a ticket printer fails or runs out of paper an alarm condition is transmitted to the DCU and the Masterloads are prevented from starting any new deliveries. Once the printer is back on line any incomplete tickets are finished. The same action takes place if the same conditions occur with a Log Printer. In addition, Masterload will not begin a new transaction until the DCU sends a message that a Log print has been produced for the previous delivery.

12.4 When the system is under computer control, deliveries will only commence when the computer is running, if the computer becomes unserviceable, any new transactions are prevented until the computer is on line again.

12.5 The system may be changed from computer to MANUAL mode by using SW1 and Flag 20. Refer to Table 3.3.
13 DCU - Flag Set Up and Example

13.1 DCU may be configured for current and future requirements by programming the software.

13.2 The software contains various entry points called “FLAGS”.

13.3 Each Flag has a two digit identity number.

13.4 Flag 00 is unalterable and contains factory preset data and issue of software.

13.5 Flag values are altered using switch SW1.

13.6 The Date and Time are set up by entering the required data into Flags 01 to 06 inclusive. Refer to Table 3.3.

13.7 The Liquid Crystal Display on the electronics board should display a number:

<table>
<thead>
<tr>
<th>DATE</th>
<th>MONTH</th>
<th>YEAR</th>
<th>HOURS</th>
<th>MINUTES</th>
<th>SECONDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>

13.8 Passcode.

13.9 Press the red button once and the display changes to PASSCODE 0000. Enter 3256 by holding the red button until the correct digit is displayed and release. The cursor will automatically move to the next digit. To move the cursor without changing a digit quickly press and release the red button.

NOTE:

The DCU display will time out 5 seconds after the last red button press. Any Flag changes will need to be confirmed by powering OFF and ON.

13.10 Press and release switch SW1. Flag 00 should now appear on the L.C.D. with a cursor below the first numeral on the left.

**FL 00 DCU 3.2**

13.11 Press and release SW1 and cursor will move to the right, below the second numeral.

**FL 00 DCU 3.2**

NOTE:

If a delay of 5 seconds occurs between each press of SW1 the software will automatically “time-out” and revert to displaying Date and Time. If SW1 is pressed and released, Flag 00 will once again appear on the L.C.D. All alterations made prior to “time-out” are saved and become the working co-ordinates for the system.

13.12 Press and hold SW1 and the cursor highlighted numeral will increment from 0 to 9. Release SW1 when “1” appears.

13.13 The L.C.D. should now display Flag 01 and its current values.
13.14 When SW1 is released and cursor will move across to the next numeral on the right.

FL 01 DATE 01

13.15 Press and hold SW1 and numeral will increment. Release SW1 when required value is reached, the cursor will move to the final numeral.

FL 01 DATE 01

13.16 Press and hold SW1 as before and release when required value is reached.

13.17 Wait 5 seconds for "time-out".

13.18 The L.C.D. should now display Date and Time beginning with the two values entered into Flag 01.

13.19 Repeat the above procedure to set values for Flags 02 to 06 inclusive. Refer to Table 3.3.

NOTE:

When Flag 06 (seconds) is set, the software automatically adds 5 seconds to required value to compensate for "time-out".

13.20 All Flags are set-up using the above procedure.

13.21 Flags other than 01 to 06 require the power supply to be switched OFF and back ON again after "time-out" to instigate flag value alterations. "Time-out" will only store these altered flag values.

13.22 The DCU is configured using switch SW1 for “Flag Settings” in conjunction with switch SW2 for “setting the inputs for equipment connected”.

13.23 In the following set-up example a DCU has 7 Masterloads, a computer connected via the RS232 Interface (CTS - “clear to send” is not required) and a Log Printer.

13.24 Switch SW2 is configured for the equipment connected as follows:

Position 2.1 OFF..............................No ticket printer
Position 2.2 ON..............................Log printer connected
Position 2.3 ON..............................RS232 connected
Position 2.4 OFF..............................“CTS” not used
13.23 Whatever positions 2.1 to 2.4 are set to ensure that relevant flag values are also set to match i.e. position 2.2 on set-up example is set to ON - Log Printer connected. Flag 10 must therefore be set to "LOG".

### FL 10 LOG

13.24 Flag 10 toggles four separate options. Moving cursor below text and holding SW1 causes text to scroll.

Options displayed are:

- LOG
- TICKET
- LOG & TICKET
- NO PRINT

13.25 Releasing SW1 when "LOG" appears will choose option. Time-out will save option. Power OFF and ON will instigate option.

13.26 The flag values required for the set-up example are as follows:

- FLAG 10 - "LOG" - Log printer connected.
- FLAG 11 - "07" - Set for the number of Masterloads* connected

*These must be connected in numerical sequence i.e. positions 01 to 07 on the Comms Board.

- FLAG 12 - "NO FLAGS" - Set so as not to print all Masterload flags on power up.
- FLAG 13 - "00" - Set to 00 as facility not required. Only relevant in computer mode for a multiple bus structure.
- FLAG 20 - "COMPUTER" - Set to computer control mode.
- FLAG 21 - "9600 BAUD" - Protocol information.**
- FLAG 22 - "SLAVE 024" - Protocol information.**

**Detailed Protocol information is available on request to Avery-Hardoll.

13.27 For dynamic reading of Internal and External memory Flags 41 and 42 are used and do not "time-out".

13.28 Change to another flag number to "time-out".
<table>
<thead>
<tr>
<th>FLAG NUMBER</th>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>FL 00 ISSUE 1.0</td>
<td>Software Issue 1.0 - unalterable</td>
</tr>
<tr>
<td>01</td>
<td>FL 01 DATE**</td>
<td>Date** = 01-31 Default = 01</td>
</tr>
<tr>
<td>02</td>
<td>FL 02 MONTH**</td>
<td>Month** = 01-12 Default = 01</td>
</tr>
<tr>
<td>03</td>
<td>FL 03 YEAR**</td>
<td>Year** = 00-99 Default = 00</td>
</tr>
<tr>
<td>04</td>
<td>FL 04 HOUR**</td>
<td>Hour** = 00-23 Default = 00</td>
</tr>
<tr>
<td>05</td>
<td>FL 05 MINS**</td>
<td>Mins** = 00-59 Default = 00</td>
</tr>
<tr>
<td>06</td>
<td>FL 06 SECS**</td>
<td>Secs** = 00-59 Default = 00</td>
</tr>
<tr>
<td>07</td>
<td>FL 07</td>
<td>Unused</td>
</tr>
<tr>
<td>08</td>
<td>FL 08</td>
<td>Unused</td>
</tr>
<tr>
<td>09</td>
<td>FL 09</td>
<td>Unused</td>
</tr>
</tbody>
</table>
| 10          | FL 10**        | Printer connected
  * = NO PRINT LOG
  ** = LOG & TICKET
  Default = LOG |
| 11          | FL 11 MLOAD**  | No. of Mloads connected
  ** = 01-15
  Default = 01 |
| 12          | FL 12*         | Print Mload Flags On
  * = 00-20 H
  Default = NO FLAGS |
| 13          | FL 13 BUS NO** | Computer Bus No.
  ** = 00-20 H
  Default = 00 |
| 14          | FL14 PRINT LOG COMPU LOG | Not normally used |
| 15          | FL15 CUST TCKT | (Use a Customer Pre-Printed ticket on BOL Printer Local only)
  NORM TCKT | (DCU Prints complete Ticket on BOL Printer Local) |
<p>| 16          | FL16           | Unused |
| 17          | FL 17          | Unused |
| 18          | FL 18          | Unused |</p>
<table>
<thead>
<tr>
<th>FLAG NUMBER</th>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>FL 19</td>
<td>Unused</td>
</tr>
</tbody>
</table>
| 20          | FL 20*  | Computer or Manual Operation  
* = COMPUTER  
MANUAL  
Default = COMPUTER |

**FLAGS 21-23 ARE ONLY ACCESSIBLE IN COMPUTER MODE**

<table>
<thead>
<tr>
<th>FLAG NUMBER</th>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>FL 21*</td>
<td>Baud Rate Computer Link</td>
</tr>
</tbody>
</table>
| 22          | FL 22 SLAVE*** | DCUs Slave Address  
*** = 001-126  
Default = 001 |
| 23          | FL 23*  | Computer Interface = RS232, RS485  
Always set to RS232 even if RS485 connection is used |
| 24          | FL 24 DATA CHNG  
DATA REQ  
DATA TX | Not normally used |
| 25          | FL 25 INIT S  
INIT SN  
INIT SNM  
INIT SNMA  
INIT ALL | Not normally used |
| 26          | FL 26   | Unused      |
| 27          | FL 27   | Unused      |
| 28          | FL 28   | Unused      |
| 29          | FL 29   | Unused      |
| 30          | FL 30 TEST-1* | Display Test  
* = 0-1  
Default = 0 |
| 31          | FL 31 TEST-2* | Communications Test  
* = 0-1  
Default = 0 |
| 32          | FL 32 TEST-3* | External Ram Test  
* = 0-1  
Default = 0 |
| 33          | FL 33 TEST-4* | Computer Link Test  
* = 0-2 (1 = Slave, 2 = Master)  
Default = 0 |
| 34          | FL 34 TEST-5* | Printer Test  
* = 0-1  
Default = 0 |
| 35          | FL 35 TEST-6* | EPROM Test  
* = 0-1  
Default = 0 |
<p>| 36          | FL 36 TEST-7 | No longer used |</p>
<table>
<thead>
<tr>
<th>FLAG NUMBER</th>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>FL 37</td>
<td>Unused</td>
</tr>
<tr>
<td>38</td>
<td>FL 38 PR-DEMO</td>
<td>Unused</td>
</tr>
<tr>
<td>39</td>
<td>FL 39 TEST-10*</td>
<td>Soak Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* = 0-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default = 0</td>
</tr>
<tr>
<td>40</td>
<td>FL 40 NO *****</td>
<td>Transaction No.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unalterable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default = 000000</td>
</tr>
<tr>
<td>41</td>
<td>FL 41** = XXXX</td>
<td>Internal Memory Read</td>
</tr>
<tr>
<td></td>
<td></td>
<td>** = 00-FF</td>
</tr>
<tr>
<td>42</td>
<td>FL 42**** = XXXX</td>
<td>External Memory Read</td>
</tr>
<tr>
<td></td>
<td></td>
<td>**** = 0000-FFFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default = 0000</td>
</tr>
<tr>
<td>43</td>
<td>FL 43</td>
<td>Unused</td>
</tr>
<tr>
<td>44</td>
<td>FL 44</td>
<td>Unused</td>
</tr>
<tr>
<td>45</td>
<td>FL 45</td>
<td>Unused</td>
</tr>
<tr>
<td>46</td>
<td>FL 46</td>
<td>Unused</td>
</tr>
<tr>
<td>47</td>
<td>FL 47</td>
<td>Unused</td>
</tr>
<tr>
<td>48</td>
<td>FL 48</td>
<td>Unused</td>
</tr>
<tr>
<td>49</td>
<td>FL 49 CODE****</td>
<td>Passcode Entry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default = 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code 5841 = Go to Default</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not used from Issue 3.1</td>
</tr>
<tr>
<td>50</td>
<td>FL 50 ID SIZE 0</td>
<td>ID SIZE 1-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local ID disabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local ID enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: size must match Masterload ID setting which must also be in single ID Mode. Not enabled with Flag 20 in COMPUTER Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uses Flag 60 to 69 to set 10 unique ID numbers for ID Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uses Flag 60 and 61 to set a range of valid ID numbers for ID Mode</td>
</tr>
<tr>
<td>51</td>
<td>FL 51 SPECIFIC</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reset ID’s to zero</td>
</tr>
<tr>
<td>52</td>
<td>FL 52 ID RESET</td>
<td>resets ID’s to zero</td>
</tr>
<tr>
<td>55</td>
<td>FL 55</td>
<td>Start of ID range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Used in conjunction with Flag 50 &amp; Flag 51 set to range</td>
</tr>
<tr>
<td>56</td>
<td>FL 56</td>
<td>End of ID range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Used in conjunction with Flag 51 set to range</td>
</tr>
<tr>
<td>60</td>
<td>FL 60 000000</td>
<td>ID 0</td>
</tr>
<tr>
<td>61</td>
<td>FL 61 000000</td>
<td>ID 1</td>
</tr>
<tr>
<td>62</td>
<td>FL 62 000000</td>
<td>ID 2</td>
</tr>
<tr>
<td>63</td>
<td>FL 63 000000</td>
<td>ID 3</td>
</tr>
</tbody>
</table>
### 14 PRINTER SET UP EXAMPLE

14.1 The following example is the Set Up procedure for connecting an EPSON FX880 printer using a RS232 interface. If another type of printer is used the relevant printer manual should be consulted.

14.2 On the serial board, inside the printer, set the following:

**DIL Switch:**
- SW1.1 = ON
- SW1.2 = ON
- SW1.3 = ON
- SW1.4 = OFF
- SW1.5 = ON
- SW1.6 = OFF
- SW2.1 = ON
- SW2.2 = OFF
- SW2.3 = ON
- SW2.4 = ON
- J1, J2, J3 = FACTORY DEFAULT

14.3 **EPSON FX870 series printers:**

14.4 **INTERNAL AND EXTERNAL SWITCH SETTINGS**

The serial board fitted inside the printer has one set of switches and some jumpers fitted to its surface. For communication to a DCU, the jumpers should remain at their factory settings, as follows:
- J1 = OFF
- J2 = ON
- J3 = OFF
- J4 = ON
- JG = OFF

14.5 The two important sets of switches are SW1 (which can be switched externally), and SW2 (contained on the surface of the PCB). These must be set as follows:

<table>
<thead>
<tr>
<th>FLAG NUMBER</th>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>FL 64 000000</td>
<td>ID 4</td>
</tr>
<tr>
<td>65</td>
<td>FL 65 000000</td>
<td>ID 5</td>
</tr>
<tr>
<td>66</td>
<td>FL 66 000000</td>
<td>ID 6</td>
</tr>
<tr>
<td>67</td>
<td>FL 67 000000</td>
<td>ID 7</td>
</tr>
<tr>
<td>68</td>
<td>FL 68 000000</td>
<td>ID 8</td>
</tr>
<tr>
<td>69</td>
<td>FL 69 000000</td>
<td>ID 9</td>
</tr>
</tbody>
</table>
SW1.6 = OFF

14.6 General printer requirements when connected to the DCU:

14.7 If the printer in use is not one supplied by Avery–Hardoll, these general conditions should be set to enable correct communication.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>RS232</td>
</tr>
<tr>
<td>BAUD RATE</td>
<td>1200</td>
</tr>
<tr>
<td>PARITY</td>
<td>ODD</td>
</tr>
<tr>
<td>WORD LENGTH</td>
<td>8 BITS - (1 stop bit)</td>
</tr>
</tbody>
</table>
Chapter 4

FAULT FINDING

1. FAULT FINDING

1.1 Faults occurring with the DCU and associated equipment will, in most cases, show as:

   Failure of printers (power supply OFF, cable fault, out of paper, printer set—up).
   Loss of communication to and from Masterload (cable fault).
   Loss of communication to computer (cable fault).

1.2 Faults may also occur to the system in which DCU has been installed. Operation and Maintenance procedures correctly carried out should keep faults to a minimum.

1.3 The following table is a guide for possible faults and causes, with remedies that can be carried out by the operators maintenance staff.

1.4 If a fault cannot be cured by the remedies listed, advice should be sought from Avery—Hardoll.

<table>
<thead>
<tr>
<th>FAULT</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank LCD display, printers inoperative.</td>
<td>Power supply update.</td>
<td>Check main supply, eliminate cause of failure.</td>
</tr>
<tr>
<td>Masterload Transactions Halted</td>
<td>Printer “off line”.</td>
<td>Check power is ON.</td>
</tr>
<tr>
<td></td>
<td>Computer “off line”.</td>
<td>Check connections.</td>
</tr>
<tr>
<td></td>
<td>Wiring fault.</td>
<td>Check supply wiring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check power supply to Electronics Board at Terminal Block 1 (240/110V) or Terminal Block 2 (12/24V).</td>
</tr>
<tr>
<td></td>
<td>Fault on Electronics Board.</td>
<td>With power ON, check LED on Regulator. If illuminated and no Liquid Crystal Display, renew the Electronics Board. (Chapter 5 Section 3).</td>
</tr>
</tbody>
</table>
### TABLE 4.2 COMMUNICATION FAULTS

<table>
<thead>
<tr>
<th>FAULT</th>
<th>POSSIBLE CAUSES</th>
<th>TEST METHOD</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masterload not responding to RUN command</td>
<td>Faulty connection to DCU.</td>
<td>Carry out Masterload ‘loop back’ test at DCU by connecting TX to RX and TX to RX. Use Masterload Flag 22 to run test.</td>
<td>Correct any wiring faults.</td>
</tr>
<tr>
<td>Faulty communications tracking on PCB.</td>
<td>Move Masterload communication to another input terminal block.</td>
<td>Leave communications at new position or change communications board if faulty</td>
<td></td>
</tr>
<tr>
<td>Faulty communications board.</td>
<td>Carry out Interface PCB test (test 2).</td>
<td>Change communications board if test fails.</td>
<td></td>
</tr>
<tr>
<td>Printer not functioning if the DCU is working in manual mode.</td>
<td>Check printer is correctly connected and switched on. Carry out printer test (test 1).</td>
<td>Correct any TMS or P.C. communications errors.</td>
<td></td>
</tr>
<tr>
<td>Communications failure with terminal management system or PC.</td>
<td>Test using TMS or P.C. test software.</td>
<td>Correct any TMS or P.C. communications errors.</td>
<td></td>
</tr>
<tr>
<td>Identification (ID) system selected. Incorrectly set up.</td>
<td></td>
<td></td>
<td>Check Masterload Flag 74 settings and DCU Flags 50 to 69.</td>
</tr>
</tbody>
</table>
Chapter 5

MAINTENANCE & OVERHAUL

CONTENTS

1 Routine Maintenance
2 Overhaul - General Information
3 Electronics Board Assembly - Renewal
4 Connector Bracket Assembly - Renewal
5 DCU - Testing

1 ROUTINE MAINTENANCE

1.1 Minimum maintenance is required to be carried out on the DCU, confined to keeping the unit clean, checking the security and condition of cables and connectors.

2 OVERHAUL - GENERAL INFORMATION

WARNING

WORK MUST ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL.

ELECTRO-STATIC SENSITIVE DEVICES.

• This equipment contains Electro-static sensitive devices. The precautions specified in BS EN 1000015-1 must be obeyed.
• No Arc welding is to be carried out after this equipment has been fitted. Welding can generate sufficient voltage within the equipment to severely damage the components.
• An equipment manual must be available before installation commences.
• Wiring to be independently checked before power is applied to the equipment.
• Voltages higher than the equipment specification must not be applied to the equipment.

2.2 Overhaul of the DCU consists mainly of changing faulty or damaged components within the unit.

The following components can be changed:

   Electronics Board Assembly
   Hardwire Comms Board Assembly
   Connector Bracket Assembly
   Interconnecting cables.

3 ELECTRONICS BOARD ASSEMBLY - RENEWAL

3.1 To gain access to the wiring of the Electronics Board assembly it is first necessary to remove the protective coverplate. ENSURE THAT POWER SUPPLIES ARE DISCONNECTED FROM THE CONNECTOR BRACKET BEFORE ATTEMPTING TO REMOVE THE COVERPLATE.

3.2 Remove the four screws and washers securing the coverplate to the spacers. Lift the coverplate clear, take note of the position of the earth wire.
3.3 Disconnect the communications cable from socket SKT1, and identifying all wiring, disconnect the power supplies from terminal blocks TB1 and TB2 (Fig 5.1). Disconnect the interconnecting cable from socket SKT2 and the ribbon cable from plug PL1.

3.4 Remove the two M6 nuts and washers from the top corners and the four M4 nuts and washers from the remainder of the studs securing the board to the baseplate. Carefully remove the Electronics Board, ensure spacers between the board and baseplate remain in position.

3.5 Replacement of the Electronics Board is the reverse of removal. When replacing the coverplate ensure that the earth wire is repositioned under the coverplate and secured by the mounting screw.

---

**FIG 5.1 POWER SUPPLY WIRING**

**4 CONNECTOR BRACKET ASSEMBLY - RENEWAL**

4.1 To remove the Connector Bracket Assembly, DISCONNECT EXTERNAL POWER SUPPLIES and communication link connectors.

4.2 Remove the protective coverplate as described in paragraphs 3.1 and 3.2 of this chapter.

4.3 Disconnect the communications cable from socket SKT1, and identifying all wiring, disconnect the power supplies from terminal blocks TB1 and TB2 (Fig 5.1).

4.4 Remove the eight screws securing the connector bracket to the box, carefully withdraw the connector complete with wiring from the box.

4.5 Replacement of the Connector Bracket Assembly is the reverse of removal. Ensure the voltage selection switch is set in the correct position BEFORE final connection.

4.6 When replacing the protective coverplate ensure that the earth wire is repositioned under the coverplate and secured by the mounting screw.
5 DCU - TESTING

5.1 The following tests may be carried out in-situ without the need for specialist test equipment.

5.2 **To test the Processor PCB**, switch power OFF and disconnect all external connections i.e. Log and Ticket Printers.

5.3 Set switch SW2 positions 2.1. - 2.4. to OFF

![](image)

5.4 Switch power ON. Using switch SW1, select Flag 49. The L.C.D. should display the following information:

![](image)

5.5 Input the code number 5841 using SW1. Wait for "time-out" and for the date and time to be displayed.

5.6 Switch power OFF and wait 5 seconds.

5.7 Switch power ON, the L.C.D. will now display:

![](image)

5.8 The L.C.D. will act like a digital clock updating each second. All DCU data has now been reset to default values.

5.9 Reset the date and time (Flags 01 to 06) as described in Chapter 5 section 6.

5.10 Switch power OFF for 2 minutes then switch power ON and check that date and time are still correct.

5.11 **To test the display (L.C.D.)** first ensure that the backlight on the display is illuminated properly.

5.12 Set Flag 30 (Test-1) to "1" using SW2.

![](image)
5.13 Wait for "time-out", the display will continually show an oblong block scrolling across from left to right checking each segment of the display.

5.14 Press SW1 to exit this test. Allow unit to "time-out", recheck date and time displayed. Flag 30 will default to "0" automatically.

5.15 To test the External RAM, set Flag 32 (Test-3) to "1" using SW2.

5.16 Wait for "time-out", the display will show either PASSED EXT RAM or FAILED EXT RAM.

5.17 Flag 32 will default to "0" automatically. To exit test switch power OFF.

5.18 To test Ticket Printer switch power OFF and select the following positions on switch SW2:

- SW 2.1 = ON
- SW 2.2 = OFF

5.19 Connect the Ticket Printer to the correct output.

5.20 Switch power ON to the printer and then the DCU.

5.21 Set Flag 34 (TEST-5) to a "1" using SW2.

5.22 The display will show TESTING PRINTER.

5.23 The Ticket Printer should print the following test message: TICKET PRINTER TEST 0123456789 THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG.

5.24 When the printer has finished, the display will show either PRINTER PASSED or FAILED message.

5.25 Disconnect the Ticket Printer from the DCU.

5.26 The display should now show a PRINTER FAILED message.
5.27 **To test Log Printer** set switch SW2 position 2.1 to OFF and 2.2 to ON.

![Switch positions diagram](image)

5.28 Disconnect the Ticket Printer. Connect the Log Printer.

5.29 The test will now repeat itself for the Log Printer.

5.30 Reset switch SW2 position 2.1 to ON and reconnect the Ticket Printer to the DCU.

5.31 To exit test, switch power OFF. Flag 34 will default to "0" automatically.

5.32 **Interface PCB Test (Test-2).**

5.33 Switch power off.

5.34 Connect the twisted-pairs as:

<table>
<thead>
<tr>
<th>TX1, TX1</th>
<th>to</th>
<th>RX2, RX2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX2, TX2</td>
<td>to</td>
<td>RX3, RX3</td>
</tr>
<tr>
<td>TX*, TX*</td>
<td>to</td>
<td>RX1, RX1</td>
</tr>
</tbody>
</table>

5.35 Switch power on.

5.36 Using the set-up key, set Flag 31 (Test 2) to a ‘1’

```
FL 31 TEST-2  1
```

5.37 After the timeout the display will show "START F/O TEST". Pressing the key will start the test.

5.38 Once the test is complete the display will show either “F/O PASSED DCU *” (* is the build size of the DCU) or “* F/O FAILURES” (* is the number of failures).

5.39 After 5 seconds the unit will revert back to step 5.37.

5.40 To exit the test power the unit off.

5.41 Remove the loopback connectors.
Chapter 6
SPARE PARTS

CONTENTS

Para
1 General information
2 Parts List

1 GENERAL INFORMATION

1.1 When ordering spare parts please quote the following information:

- Part number and Description.
- Publication TP reference number and issue.
- Figure number (e.g. 9.1-1 )

1.2 ‘+’ in the Fig/Item No. column indicates Item is not illustrated.

1.3 ‘*’ in the Part No. column indicates Item is recommended to be held as a spare part.
## FIG 6.1 DCU SPARE PARTS

<table>
<thead>
<tr>
<th>Fig/Item No.</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 DCU</td>
<td>1</td>
<td>ZPMS1-244 ELECTRONICS BOARD ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>ZEMZ0152-5 FUSE 3A QUICK BLOW</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>ZEMZ0152-31 FUSE 2A</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>BEMZ1097 CONNECTOR BRACKET ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>ZPMZ1-279 HARDWIRED COMMS BOARD</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5A</td>
<td>ZPMS1-279 HARDWIRED COMMS BOARD FOR BEMY130 (STEEL BOX)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>BEMZ1096 RIBBON CABLE ASSEMBLY</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>7</td>
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