

# 1523

## Digital Wattmeter Instruction Manual



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## SECTION - 1 SAFETY INSTRUCTIONS

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

1.  This indicates refer to the manual wherever necessary.

2. E /  Indicates Protective Ground Terminal.

3.  Indicates Danger ! High Voltage.

4. Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

5. Use the Proper Fuse

To avoid fire hazard, use only the fuse of correct type, voltage rating and current rating as specific in the parts list for your product. Refer fuse replacement to qualified service personnel.

6. Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

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## SECTION - 2 TECHNICAL SPECIFICATIONS

**2.1 Measuring Parameters :** True RMS V, A, VA, W and Frequency.

**2.2 Measuring Limits**

- a) Voltage : 75V to 130V (115V operation).
- b) Current : 0.2 to 20A rms AC (40A peak).
- c) Volt Amperes : 16 to 2600VA.
- d) Power : 1 to 2600W.
- e) Power Factor : 0.5 to unity (No display).
- f) Frequency : 45 to 65Hz.

**2.3 Measurement Accuracy**

- a) Voltage / Current : 0.5% of reading  $\pm 1$  digit.
- b) Volt Amperes/Power: 1% of reading  $\pm 2$  digits.
- c) Power Factor : 2% of reading  $\pm 2$  digits.
- d) Frequency : 0.25% of reading  $\pm 1$  digit.

**Note :** i) Accuracy valid only between above specified measurement limits.

ii) For VA, Power accuracies are valid only when voltage and current are between their respective limits.

**2.4 Measurement Resolution**

- a) Voltage : 0.1V.
- b) Current : 1mA upto 1 Amp., 10 mA above 1Amp.
- c) Volt Amperes : 1VA.
- d) Power : 1 Watt.
- e) Frequency : 0.01Hz.

**2.5 Miscellaneous**

- a) Display : 16x2 Alphanumeric LCD display.
- e) Interface : RS232.

**2.6 Power :** 75V to 130V (115V operation).

**2.7 Instrument Power Consumption :** 9W approx.

**2.8 Operating Temperature :** 5°C to 50°C, 90% RH.

**2.9 Dimensions (mm) :** 155 (W) x 190 (H) x 286 (D) approx.

**2.10 Weight :** 3 Kg. approx.

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## **SECTION - 3 GENERAL DESCRIPTION**

### **3.1 INTRODUCTION**

Global Specialities' 2.6KW AUTOSCAN TRUE RMS POWER METER, MODEL 1523 is a state-of-the-art instrument, ideal for providing all the information about any electrical load connected to the AC Mains. It monitors/scans sequentially all electrical parameters viz., Voltage, Current, Power, VA, & Mains Frequency, thus providing a clear picture of the load.

User operation is very simple. The load which is to be monitored is connected to the 'Output' Socket provided on the rear panel of the 1523 instrument. Each output is rated upto 130V & 10A rms current. The instrument is then connected to the 115V AC mains. All the parameters are then displayed on the LCD on front panel of the instrument.

An optional facility of remote communication has been provided. Through this, an external PC can control the instrument and obtain information from it. This is possible by making use of a set of commands, details of which are explained later.

### **3.2 RECEIVING INSTRUCTIONS**

The instrument is packed in a corrugated box. For unpacking, remove the box cover & packing material. Then bring out the instrument from the box.

Check carefully, whether there is any physical damage to the instrument during transit. Inform the carrier about the damage alongwith the serial number of the instrument (located on the bottom cover).

### **3.3 POWER REQUIREMENTS**

The wiring of the instrument is done as per the marking on the rear panel, viz 'Mains In' 105V - 130V AC, 50/60Hz.

### **3.4 INSTALLATION**

The instrument is ready for operation when shipped from the factory. The appliance/load whose power is to be monitored should be at a safe distance from the instrument. This prevents unnecessary heating up of the instrument.

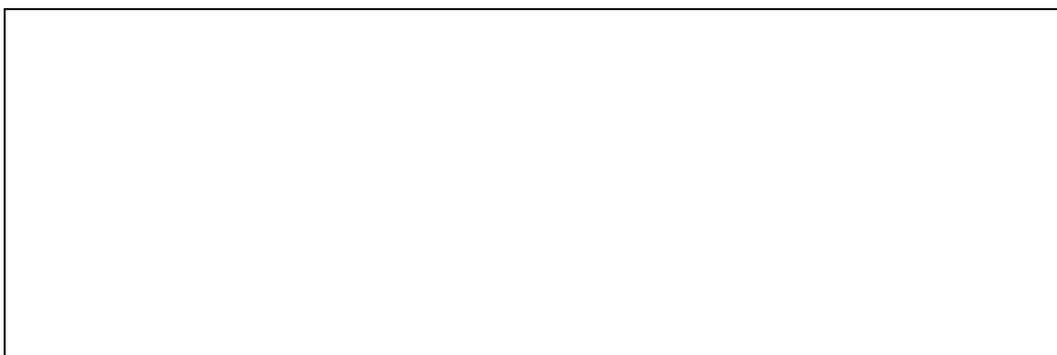
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## SECTION - 4 OPERATING INSTRUCTION

### 4.1 IDENTIFICATION OF CONTROLS



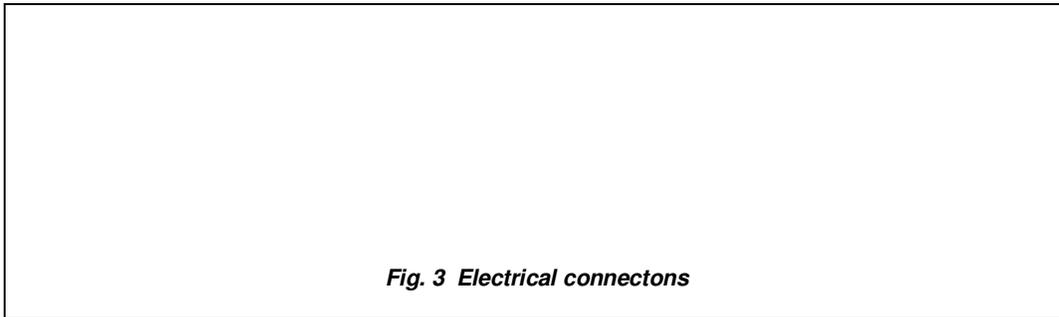
1. **V** - This key is to display the measured mains rms voltage in Volts on LCD.
2. **W** - This key is to display the power consumed by load, every second, on LCD.
3. **F** - This key is to display the mains frequency in Hz on LCD.
4. **I / RANGE** - This key is to display the rms value of measured load current in Amps on LCD.
5. **VA** - This key is to display the volt-amp of load on LCD and it is updated every second.
6. **AUTO SCAN / GL** - If instrument is not in remote mode then this key acts as entry into auto scan mode. All parameters ie V,I,W,F,VA are scanned sequetially with a period of 1 second.  
If any other key is pressed in auto scan mode,then unit comes out of auto scan mode and the selected parameter is displayed.  
If the unit is in remote mode of operation,this key acts as Go Local key.It brings the unit into local mode of operation.
7. **DISPLAY**- This is 16 x 2 Alphanumeric LCD display with green backlight.



1. **Mains In** - Cord for delivering Mains Power(115V ac) to the instrument.
2. **Output** - Socket for plugging in the appliance / load to be monitored. There are 2 sockets to share the load of 20A equally.
3. **Load Switch** - Turns ON/OFF outgoing power to the load. There are 2 switches for 2 output sockets.
4. **Fuse** - Protective Fuse between mains & load.
5. **RS232 Interface Connector** - External PC communicates to the instrument using this connector.

#### 4.2 ELECTRICAL CONNECTIONS & MEASUREMENT

Follow the diagram & the instructions given below :



**Fig. 3 Electrical connectons**

- a) Switch OFF the equipment under test.
- b) Connect the Mains plug of the equipment/appliance, whose power is to be measured into one of the Output sockets (2) of the 1523
- c) With the corresponding load switch (3) of the 5051A in the 'OFF' position, Turn the mains power on.
- e) Switch ON the equipment/appliance & switch on the supply to the load with the corresponding load switch(3).

**Note :** It is recommended that the 1523 be first switched ON and then the equipment under test.

#### 4.3 METER OPERATION

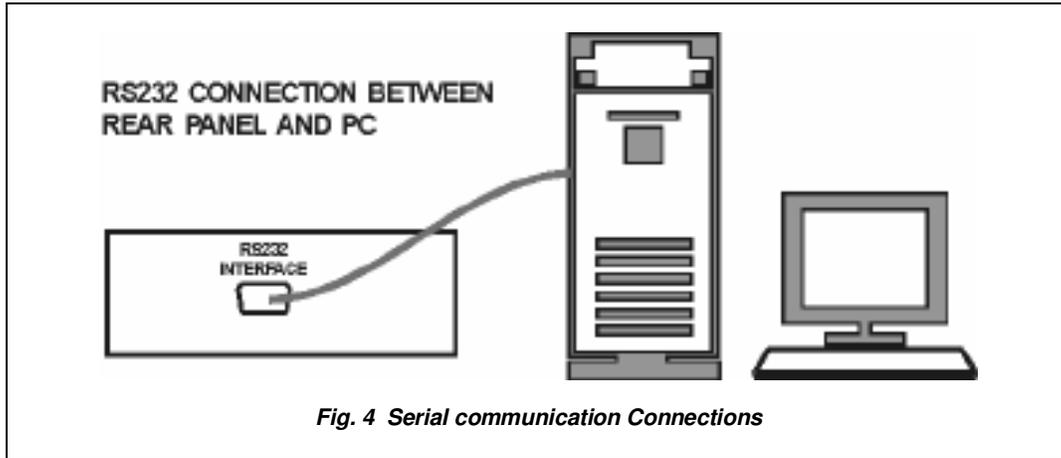
The 'LCD display' (7) on front panel shows the measured parameter selected. On power 'ON', the Manual Scan mode is chosen. In this mode parameter selected with front panel key displayed constantly on display.

1. **Note :** If the user connects some load to the instrument & switches it on with help of load switch(3) and if the current displayed by the instrument is 0.000A then it indicates a blown fuse. User should replace it with a new fuse.
-

## SECTION - 5 REMOTE COMMUNICATION

### 5.1 INTRODUCTION

By using the remote communication facility and the set of remote commands, a PC can completely control the instrument and get information from it. During remote communication, front panel is disabled (except Go Local key) as long as the remote PC doesn't relinquish control of the instrument or the GO Local key on front panel is pressed. Follow the diagram below for connections.



- a) Connect the com port of the PC to the female 9 pin D-type 'RS232' interface connector (5) on the rear panel of the instrument.
- b) Run any communication software like hyper terminal on the PC to communicate to the instrument. Communication protocols are described as under.

### 5.2 COMMANDS FOR COMMUNICATION

**Note :** 1.Set Baud Rate = 9600 bits per second for serial communication.

**Command Set:-**

1. RV - Set 'V' function & Read input voltage in volts.  
e.g. **XXX.X 'V'**
2. RI - Set 'I' function & Read load current in amperes.  
e.g. **X.XXX 'A' or XX.XX 'A'**
3. RP - Set 'P' function & Read apparent power in Volt-Amperes.  
e.g. **XXXX 'VA'**
4. RW - Set 'W' function & Read Actual power in Watts.  
e.g. **XXXX 'W'**
5. RF - Set 'F' function & Read mains frequency in Hz.  
e.g. **XX.XX 'Hz'**
6. GL - To come out of Remote operation (i.e. Local Mode). This command is acknowledged by an answerback character. i.e. 'Y'.
7. SA - To enter into auto scan mode of all parameters. This command is acknowledged by an answerback character. i.e. 'Y'.
8. Z - To flush buffer.

**Note :** To come out of Remote mode, GL switch on front panel can also be used.

### 5.3 NOTES REGARDING COMMUNICATION

- i) Definition of signals on 'RS232' interface connector on rear panel (5) for remote communication.

Pin No.	Signal	Source	Description
2	RXD	Remote PC	Receive data from Remote PC
3	TXD	Instrument	Transmit data to Remote PC
5	Gnd	—	Signal Gnd

- ii) Communication parameters

Bits per second	-	9600
Data bits	-	8
Parity	-	None
Stop bits	-	1
Flow Control	-	None

- iii) The commands to the instrument should be in upper case letters only.

- iv) The instrument will not recognise if any wrong command is sent. Use flush buffer command before proceeding.
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## SECTION - 6 TESTING & CALIBRATION PROCEDURE

**6.1 TITLE :** Testing & Calibration Procedure of Power Meter 1523

**6.2 REF. DOCUMENTS :** 5050Power Meter Test Procedure.

**6.3 EQUIPMENTS :**

- 1) Power Meter
- 2) Voltmeter for AC Voltage & Current Meter up to 20A true RMS type.
- 3) Variac sourcing current up to 20A.
- 4) Frequency Counter.
- 5) Load up to 20A AC.

**6.4 PROCEDURE :**

**6.4.1 Testing of PCBs :**

1. Check all the PCBs for dry solder, loose contact of components capacitor polarities & ratings etc.
2. Check for proper contacts of smd resistor networks of 10Kohms, on Main Board.
3. Connect all the Boards as per wiring diagrams.

**6.4.2 Testing of Power Supply :**

1. Switch on the Mains supply ( 115V ) to the unit.
2. Check the various supply voltages on CPU Board such as +5V, -5V at test points TP3 & TP4 wrt GND & reference voltage with U1-12 should be 2.500V wrt GND.

**6.4.3 Power on Display :**

Switch on mains. On power on welcome message appears which is as follows :

```
APLAB MODEL   :      1523  
TRUE RMS MAINS:      POWER METER  
VERSION       :      V 1.00
```

Now the system carries out eprom-test & initializes the system variables if necessary. On Successful EPROM test is shown.

```
EPROM TEST    :      OK
```

Else the following message is displayed :

```
EPROM TEST    :      FAIL  
V  : ININ     W :      IGNOR
```

If V key is pressed it initializes the eprom. If the system is unable to initialize the eprom, it displays following message on 2nd line of display:

```
EPROM ERROR   : Else if W key is pressed it ignores EPROM fail. Now Mains voltage screen is displayed on LCD.
```

**6.4.4 Testing Microcontroller 859S52 :**

1. Check for momentary high ( +5V ) pulse at pin 9 (RESET) of 89S52 on power on or pressing reset switch SW1 on CPU board.
2. Check pin 30 (ALE) of U1 (89S52) to be a pulse signal of 2MHz with counter.
3. Check frequency at TP1 wrt GND to be 2MHz with counter.
4. Keep all other presets & trimmers in middle position. Adjust preset VR1 on CPU board for proper contrast of LCD.

6.4.5 Testing of Manual & Auto Mode :

1. All the parameters can be viewed with the keys on front panel i.e. V, I, W, VA, F.
2. Compare V & I values on display with standard DMM. Also calculate & compare VA & Power for ( for resistive load power should be equal to VA ).
3. Auto scanning of all parameters can be done by pressing Auto scan / GL key. Auto scanning is done at speed of 1 Sec. To come out of auto scan mode, press any other key.

6.4.6 Mains Voltage Calibration :

Set mains input voltage to the unit is at 115.0 Volts at 50/60Hz frequency and monitor voltages at DMM & Power meter simultaneously. Adjust the display to be the same with help of preset VR1 on main board. Check voltages for the range specified ( 75V - 130V ).

6.4.7 Mains Current Calibration :

1. Connect 500mA of load to the system & adjust 0.500A on power meter display with the help of preset VR2.  
Now to calibrate the current throughout the range up to 20A, following procedure is to be followed.
2. Connect 250mA load physically & switch off the load switch on the meter.
3. To enter software calibration mode, reset the system & press Fkey. After successful eeprom test, systems shows following screen.

**CALIBRATION ?**

**YES = PRESS W KEY**

**NO = PRES VA KEY**

4. If VA key is pressed then the system exists calibration mode & mains voltage in manual mode is displayed.
5. To go into calibration mode, connect port pin 1.5 ( pin 5 of U2-89S52 ) to ground & press W key.
6. Go to current mode by pressing I switch. 'CAL' message will be displayed along with normal manual current mode screen.
7. W & VA keys will now function to increase & decrease the display counts respectively.
8. Use standard DMM to get same current on standard meter and on power meter.
9. Press F & AUTO SCAN/GL keys simultaneously to save the calibrated current value & Exit Software Calibration Mode. The message 'CALIBRATION SAVED' will be flashed to confirm saving.
10. Follow steps from 2 to 9 to calibrate the system on loads of 750mA, 5A & 15A & then verify all readings.
11. Software Calibration mode will exit automatically without saving changes after 25 sec of idle operation, it will show following message on display :

**CALIBRATION  
TIMEOUT**

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## SECTION - 7 PART LIST

PCB Components      5051A-MAIN-0306 IRD 551

Ref Designator	Value
<b><u>RESISTORS</u></b>	
R1	470E SMD 0805 CHIP
R2	470E SMD 0805 CHIP
R3	16E CHIP 1/8W 1206
R4	1K 1% 0805 0.125W SMD
R5	10E SMD 0805 CHIP
R6	10K SMD 0805 CHIP
R7	12K SMD 0805 CHIP
R8	470E SMD 0805 CHIP
R9	470E SMD 0805 CHIP
R10	1K 1% 0805 0.125W SMD
R11	1K 1% 0805 0.125W SMD
R12	10K SMD 0805 CHIP
R14	10K SMD 0805 CHIP
R15	330E SMD 0805 CHIP
R16	1K 1% 0805 0.125W SMD
R17	620E SMD 0805 CHIP
R18*	10K SMD 0805 CHIP
R19	10K SMD 0805 CHIP
R20	100K 1% 0805 0.125W SMD
R21	2K4 SMD 0805 CHIP
R22	10K SMD 0805 CHIP
R23	2K7 1% 0805 0.125W SMD
R28	220E SMD 0805 CHIP
R29	20K SMD 0805 CHIP
R30*	1K8 0805 0.125W SMD
R31	220E SMD 0805 CHIP
R32	10E SMD 0805 CHIP
R33*	10K CHIP 1/8W 0805
<b><u>NETWORK</u></b>	
RN1 TO RN9	10KE X4 x 1 COM 5 SMD
<b><u>PRESETS</u></b>	
VR1	TRIMPOT 200E 10 TURN BOURNS
VR2	TRIMPOT 200E 10 TURN BOURNS
VR3	10K TRIMPOT HORZ
<b><u>CAPACITORS</u></b>	
C1	10pF / 50V SMD CHIP 10% 0805
C2	10pF / 50V SMD CHIP 10% 0805
C3	10μF / 16V 2010MIL SMD ELE RAD
C4	100nF / 50V 10% 0805SM
C5	10μF / 16V 2010MIL SMD ELE RAD
C6	100nF / 50V 10% 0805SM
C7	100nF / 50V 10% 0805SM
C8	100nF / 50V 10% 0805SM
C9	220pF / 35V SMD CHIP 0805
C10	220pF / 35V SMD CHIP 0805
C12	18nF SMD 0805
C13	220pF / 35V SMD CHIP 0805
C14	220pF / 35V SMD CHIP 0805

**PCB Components 5051A-MAIN-0306 IRD 551**

<b>Ref Designator</b>	<b>Value</b>
<b><u>CAPACITORS</u></b>	
C16	18nF SMD 0805
C17	100nF / 50V 10% 0805SM
C18	10µF / 16V 2010MIL SMD ELE RAD
C19	33pF SMD CHIP 0805
C20	33pF SMD CHIP 0805
C21	100nF / 50V 10% 0805SM
C22	100nF / 50V 10% 0805SM
C27	3300µF / 35V 20% ELE RAD
C28	330µF / 25V ELE RAD
C29	10µF / 16V 2010MIL SMD ELE RAD
C30	100nF / 50V 10% 0805SM
C31	10µF / 16V 2010MIL SMD ELE RAD
C32	100nF / 50V 10% 0805SM
C33	10µF / 16V 2010MIL SMD ELE RAD
C34	100nF / 50V 10% 0805SM
C35	10µF / 16V 2010MIL SMD ELE RAD
C36	100nF / 50V 10% 0805SM
C37	1µF SMD CHIP 0805
C38	100nF / 50V 10% 0805SM
C39	100nF / 50V 10% 0805SM
C40	100nF / 50V 10% 0805SM
C41	100nF / 50V 10% 0805SM
C42	100nF / 50V 10% 0805SM
C43	ELE RAD 10µF, 16V
C44	100nf 50V CFI CHIP
<b><u>CRYSTAL</u></b>	
X1	12MHz
X2	4.194304MHz
<b><u>DIODE</u></b>	
D1 TO D4	1N4003 SMD MELF1
D5	RLS4148 T E11 SMD
<b><u>ICs</u></b>	
U1	CS5460A 1PH POWER ENERGY 24 PIN TYPE SSOP
U2	89S52 UC 40 PIN 8 BIT FLASH 8KB ( DIP40 )
U3	74HC4053 16 PIN 2 CHANNEL ANALOG TYPE SO-16
U4	MNC 93C46N PI27 ATMEL MAKE ONLY
U5	LMV331 SMD 5 PIN LOW VOLTAGE COMPARATOR SOT23-5
U7	TL431-CP ADJ PRECISION REG SHUNT ( SOT23M1 )
U8	74HC14 SMD ( SO-14 ) HEX INVERTING SCHMIT TRIGGER
U9	IC UA7805UC REG / LM7805CT +5V
U10	UA7905UC REG -5V FIX
U11, U12	OP07 8 PIN SMD OP AMP ( SO8 ) ULTRA LOW-OFFSET
<b><u>CONNECTORS</u></b>	
J1	4 PIN 2.54mm MALE
J2	DUAL IN ROW UNLOC MALE STRAIGH BURGE STRIP, 16 PIN
J3	3 PIN 2.54mm MALE
J4	4 PIN 2.54mm MALE
J5	DUAL IN ROW UNLOC MALE STRAIGHT BURGE STRIP, 10 PIN
JP1, JP3, JP5	3 PIN JUMPER MALE BREG STRIP BLK
JP7	2 PIN 2.54mm JUMPER LINK SIL MJ-02
<b><u>SWITCH</u></b>	
SW1	TACT SWITCH TINY

**PCB Components 5051A-RS232-0706 IRD 570**

<b>Ref Designator</b>	<b>Value</b>
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**RESISTORS**

R1	1K SMD CHIP 1% 0.125W 0805
R2	10K SMD CHIP 0805
R3	200E SMD CHIP 0805
R4	2.4K SMD CHIP 0805
R5	1K SMD CHIP 1% 0.125W 0805
R6	10K SMD CHIP 0805
R7	200E SMD CHIP 0805
R8	2.4K SMD CHIP 0805
R9	220E SMD CHIP 0805

**CAPACITORS**

C1	10μF / 16V 20% ELE RAD
C2	10μF / 16V 20% ELE RAD
C3	10μF / 16V 20% ELE RAD
C4	10μF / 16V 20% ELE RAD
C5	470μF / 35V 20% ELE RAD
C6	10μF / 16V 20% ELE RAD
C7	100nF / 50V 10% 0805SM
C8	100nF / 50V 10% 0805SM

**ICs**

U1	TTL TO RS232 CONVERTOR 16 PIN SMD SO-16
U2	OPTO ISOLATOR ISP817 4 PIN DIP
U3	OPTO ISOLATOR ISP817 4 PIN DIP
U4	UA7805UC REG/LM7805CT +5V

**DIODES**

D1 TO D4	IN4003 SMD MELF1
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**TRANSISTORS**

Q1, Q2	MMBT3906 PNP SWITCHING SMD SOT23
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**CONNECTORS**

J1	3.96mm 3 PIN MALE ST MOLEX
J3	DUAL IN ROW UNLOC MALE STRAIGHT BURGE STRIP, 10 PIN
J4	4 PIN ST MALE CONN JALEX

**PCB Components ZG3M2020MTSO**

<b>Ref Designator</b>	<b>Value</b>
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**CAPACITOR**

C301, C302	CAP MP 1KV 47nF AXIAL
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**CORE**

L301	FERRET RING CORE 10 x 6 x 3
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**PCB Components      5051A-KBD-0306**

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<b>Ref Designator</b>	<b>Value</b>
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**SWITCH**

S1 TO S6	ITTD 6 KEY BOAR DBLACK HEIGHT 6mm
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**CONNECTORS**

J1	DUAL IN ROW UNLOC MALE STRAIGHT BURGE STRIP, 16 PIN
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**PCB Components      LCD ASSY-16X2 HY-1602F-205 YELLOW**

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<b>Ref Designator</b>	<b>Value</b>
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**CONNECTORS**

J1	16 PIN ST BREG STRIP BLACK
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**MECHANICALS**

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<b>Ref Designator</b>
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20A MAINS CORD
FUSE 20A
FUSE HOLDER 20A
115V SOCKETS AMERICAN 16A x 2
ON / OFF SWITCH 16A x 2

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## **SERVICE AND WARRANTY INFORMATION**

For up-to-date product information, please visit [www.globalspecialties.com](http://www.globalspecialties.com).

For instructions on how to obtain a return merchandise authorization number (RMA), please visit our website, or call our customer service department.

**GLOBAL SPECIALTIES**  
**22820 Savi Ranch Parkway**  
**Yorba Linda, CA 92887**  
**800-572-1028**  
**globalspecialties.com**

Global Specialties will service and repair this instrument free of charge for a period of 1 year, subject to the warranty conditions below.

### **WARRANTY**

Global Specialties warrants the 1523 to be free from defective material or workmanship for a period of 1 year from date of original purchase. Under this warranty, Global Specialties is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within 1 year from date of original purchase.

Units returned to Global Specialties that have been subject to abuse, misuse, damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Global Specialties, or that have been repaired by unauthorized persons will not be covered by this warranty.

Global Specialties reserves the right to discontinue models, change specifications, price or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

This warranty is in lieu of all other representations or warranties expressed or implied and no agent or representative of Global Specialties is authorized to assume any other obligation in connection with the sale and purchase of this device.

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