Issue: 2
Date: 10 March 1996
File: LDO100.MAN (WP60)

BLACK STAR
LD0100
Low Distortion Oscillator
Instruction Manual

Designed and Manufactured in the U.K by:

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SPECIFICATIONS

Frequency

Range:	<10Hz to >100KHz in 4 overlapping decade ranges with 10:1 vernier control.

Output signals

Waveforms:	Sine or Square, TTL.
Connections:	Front panel BNC, TTL rear panel BNC.
Impedance:	600Ω +/-1%.

Sine-wave mode

Amplitude:	<5mV to >5Vrms (open circuit).
THD + noise:	<0.003% 20Hz to 20KHz, bandwidth 80KHz, <0.02% 10Hz to 100KHz, bandwidth 330KHz. (Distortion measured using 0dB Attenuator and any amplitude setting).

Square-wave mode

Amplitude:	15mV to 15V peak-peak (open circuit).
Risetime:	<0.75us.
Mark/Space:	1:1 +/-1%.

Attenuator

Range:	0dB, -10dB, -20dB, -30dB, -40dB switched attenuator and rotary amplitude control providing >-20dB additional attenuation.

TTL output

Amplitude:	TTL compatible
Rise/fall:	<50ns.
Fanout:	>10 TTL loads.

Display

Type:	Microprocessor controlled 2 line x 16 character LCD, with continuous display of frequency, amplitude and mode.
Frequency error:	<1% of displayed frequency.
Amplitude error:	<1% of full scale amplitude.

General

Operating Temp:*	+0°C to 40°C
Power supply:	110/120VAC or 220/240VAC 50/60Hz, user adjustable.
VA rating:	12VA max.
Size:	219mm x 240mm x 98mm (product only). 310mm x 330mm x 135mm (packed).
Weight:	1.6kg (product only). 2.1kg (packed).
EMC:	Complies with EN50081-1 and EN50082-1

* Operating only; specifications apply from 16°C to 26°C

INTRODUCTION

The Black Star LDO100 is a Sine/Square oscillator producing very low distortion sine-waves and high quality square-waves from 10Hz to 100KHz.

The advanced circuit design of the LDO100 produces very fast response times, eliminating the 'amplitude bounce' of conventional RC oscillators.

The very low distortion of the LDO100 makes it particularly suitable for analog-digital converter, filter and audio amplifier testing.

Microprocessor controlled frequency and amplitude measurement along with the LCD display makes the LDO100 very easy to use and provides more accurate and repeatable adjustment than can be achieved with conventional analog meters and calibrated scales.

INSTALLATION

Safety Instructions.

The LDO100 has been designed to comply with IEC 348 safety requirements.
In order to maintain safe operation the instrument must be earthed to the mains voltage supply earth, via the earth conductor of the mains lead.

EMC Compatibility

This instrument complies with EN50081-1 and EN50082-1 for emission and immunity. If the instrument is operated in the prescence electromagnetic or electrostatic interference some degradation in performance may occur. If the source of interference is removed then the performance will return to that given in the specification.

Mains supply and fuses.

Before connecting the instrument to the mains supply ensure that the rear panel voltage selector switch is set to the correct position for the local mains supply voltage:

Mains supply voltage	**Correct switch position**
110 to 120VAC 50/60Hz	110/120V
220 to 240VAC 50/60Hz	220/240V

The voltage selector switch may be set to the correct position by using a flat bladed screwdriver.

Once the voltage selector has been correctly set, the instrument may then be connected to the mains supply using an IEC type mains lead and plug.

The mains fuse and spare are located in the IEC mains socket.

If the mains fuse requires replacement then the following type must be used. Fitting any other type will invalidate the Guarantee and may make the instrument unsafe.

Mains Fuse: 5 x 20mm 100mA antisurge.

CONTROLS AND OUTPUTS

Frequency.

The frequency control sets the output frequency. The output frequency is adjustable over a 10:1 range.

The set frequency is continuously displayed on the LCD.

Range(Hz).

The desired frequency range is set by selecting one of the four interlocking frequency range push-buttons. The four frequency ranges are; 10Hz-100Hz, 100Hz-1KHz, 1KHz-10KHz and 10KHz-100KHz. A small amount of frequency overlap is built into each range to ensure complete frequency coverage from less than 10Hz to greater than 100KHz.

Amplitude.

The amplitude control adjusts the level of the output signal. The attenuation ratio of the control is greater than 10:1 (0 to -20dB). The open circuit output voltage is continuously displayed on the LCD.

Attenuator (dB).

Attenuation from 0 to -40dB is provided by the five interlocking attenuator push-buttons. To select the desired attenuation ratio simply depress the corresponding push-button. The displayed output signal level is automatically adjusted to take account of the change in output voltage.

NOTE. If two or more attenuator push-buttons are depressed the output voltage will be undefined and the LCD will display the following error message;

"-Att-".

Sine/Square.

The Sine/Square push-button switches the LDO100 between sine-wave and square-wave mode. The LCD indicates the selected mode by displaying either;

"Sine" or **"Square"**.

NOTE. When sine-wave mode is selected the output signal level is displayed as Volts **"r.m.s"** and when square-wave mode is selected the signal level is displayed as Volts peak to peak, **"pk-pk"**.

Output (600Ω).

The main signal output is the front panel BNC connector. The output impedance is 600Ω +/- 1%.
WARNING. Externally applied voltages of greater than +/-15V to this output may cause permanent damage the instrument.

TTL Output.

A TTL compatible signal at the same frequency as the main output is available from the rear panel BNC connector. The duty cycle of the TTL output is 50%. The rising edge of the TTL signal is coincident with the peak of the sine-wave.

WARNING. Externally applied voltages of greater than +/-15V to this output may cause permanent damage the instrument.

OPERATING INSTRUCTIONS

Switching on the instrument.

WARNING

Before switching on the instrument, ensure that it has been correctly installed in accordance with the instructions in the INSTALLATION section.
Once the instrument has been correctly installed, it can be switched on by setting the rear panel ON/OFF switch to the ON position. The LCD will briefly display a message showing the instrument model number and current internal software version.

Although the LDO100 is ready for immediate use, a 30 minute warm up period is required to ensure maximum frequency and amplitude stability.

Setting the output wave-form.

The output wave-form is selected by pressing or releasing the SINE/SQUARE push button. The LCD indicates the currently selected wave form. The TTL signal is always available from the rear panel BNC connector.

Setting the output amplitude.

The output amplitude is set by pressing the appropriate Attenuator push-button and adjusting the rotary Amplitude control until the LCD indicates the desired voltage.

The displayed voltage is the open circuit output voltage from a source resistance of 600Ω; loading the output will reduce the voltage developed across the load in proportion to load resistance.

EXAMPLE:

Displayed Voltage - 3.00V rms
Load resistance - 150Ω
Voltage across load = 3.00 x 150/(150 + 600)=0.60V.

Setting the output frequency.

The output frequency is set by pressing the appropriate Range push-button and adjusting the rotary Frequency control until the LCD indicates the desired frequency.

Although the LDO100 settles very quickly in response to frequency range changes, it is good practice to reduce the output amplitude before changing the frequency range; this will avoid any possibility of briefly overloading the circuit under test.

Connecting to the main output.

The LDO100 generates signals of very high quality, with very little distortion or noise. High quality screened leads should used to avoid the possibility of external interference causing signal degradation; this is particularly important when outputting low level signals.

CALIBRATION

For optimum performance the instrument requires calibration from time to time. How frequently will depend on the user and the application, but once every 12 months would normally be adequate. Calibration of the LDO100 is a complex procedure involving the use of precision equipment and should only be undertaken by those with specialist knowledge. However, for those users who wish to perform their own calibration please refer to the Service Manual, which can be purchased from the manufacturer or their overseas agents.

MAINTENANCE AND REPAIR

The manufacturer, or their appointed agents overseas, will repair and calibrate any instrument developing a fault. If the instrument is returned for calibration or repair **always** observe the following points:

1. Clearly detail the claimed fault.

2. Do **NOT** return any accessories.

3. Pack the product very carefully. Whenever possible retain the original packing for this

purpose.

4. Enclose dated proof of purchase.

Where owners wish to undertake their own repairs, this should be carried out by skilled personnel, with access to precision equipment, working in conjunction with the Service Manual which can be purchased from the manufacturer or their overseas agents.

GUARANTEE

BLACK STAR Ltd will undertake to repair any product that fails within 12 months of the date of purchase provided that the equipment has not been modified or misused. Note this guarantee does not affect your statutory rights.

Designed and Manufactured in the U.K. by:

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Issue: 2
Date: 17 Aug 1995

BLACK STAR

LDO100

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Service Manual

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SPECIFICATION

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Waveforms:	Sine or Square, TTL.
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Impedance:	600Ω +/-1%.

Sine-wave mode

Amplitude:	<5mV to >5Vr.m.s (open circuit).
T.H.D + noise:	<0.003% 20Hz to 20kHz, bandwidth 80kHz, <0.02% 10Hz to 100kHz, bandwidth 330kHz. (Distortion measured using 0dB Attenuator and any amplitude setting).

Square-wave mode

Amplitude:	<15mV to >15V peak-peak (open circuit).
Risetime:	<0.75us.
Mark/Space:	1:1 +/-1%.

Attenuator

Range:	0dB, -10dB, -20dB, -30dB, -40dB switched attenuator and rotary amplitude control providing >-20dB additional attenuation.

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Amplitude:	TTL compatible.
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Weight:	1.6kg (product only). 21.kg (packed).
EMC	Complies with EN50081-1 and EN50082-1

*Operating only; specifications apply from 16°C to 26°C.

INTRODUCTION

PLEASE READ ALL OF THIS INTRODUCTION BEFORE CARRYING OUT ANY SERVICING OF THE INSTRUMENT.

SAFETY INSTRUCTIONS

These servicing instructions are for use by qualified personnel only. To avoid the risk of electric shock, the equipment must be disconnected from the mains supply voltage before dismantling.

WARNING. Any internal or external interruption of the instruments protective earth conductor, or disconnection of the earth bond point is likely to make the instrument dangerous. Do not disconnect or interrupt the protective earth.

When working on the instrument ensure all sleeving and shrouds covering the AC line (live and neutral conductors) are in place.

MAINS FUSE

The correct mains fuse type is: -5x20mm 100mA anti-surge. If the mains fuse requires replacement then only this type of fuse should be fitted. **NOTE.** The fitting of any other type of fuse will invalidate the Guarantee and may render the instrument unsafe. To gain access to the fuse follow the instructions below.

(1) Disconnect the mains supply from the LDO100
(2) Prise out the fuse drawer located within the IEC socket.
(3) The spare fuse is located in the outer position.
(4) The active fuse is located in the inner section of the fuse holder.

GENERAL

While the Black Star LDO100 Low Distortion Oscillator has been designed to be rugged, severe shocks may damage the instrument and should be avoided. Do not expose the instrument to radiant heat, including direct sunlight for prolonged periods, or high humidity. When servicing suitable precautions should be taken against electrostatic discharge as the instrument contains CMOS components.

If power is applied to the instrument DO NOT do any of the following:

Remove or replace any component
Disconnect any circuit board or cable
Solder or de-solder any connection

Servicing and calibration should only be attempted by suitably qualified personnel using the correct test equipment.

TEST EQUIPMENT

The following test equipment is needed to fully test and calibrate the LDO100:-

1) Distortion analyser with the following minimum specification:-
   (a) 0.01% f.s range
   (b) residual THD + noise of <0.001% from 20Hz to 20kHz
   (c) A residual THD + noise of <0.006% from 10Hz

to 100kHz

2) A wideband true rms AC voltmeter with an accuracy of 0.2% or better from 50Hz to 100kHz. Input impedance set to 600Ω +/-1%.

3) 20MHz general purpose analogue oscilloscope

4) Frequency counter with a resolution and accuracy of 0.01% or better from 10Hz to 100kHz

CIRCUIT DESCRIPTION

Analog Section

IC10 and part of IC11 form a 'Dual Integrator Loop' sinewave oscillator. Negative and positive feedback is used to maintain oscillation.

To ensure a stable output amplitude, the peak sinewave voltage is measured by a sample and hold circuit comprising part of IC11, part of IC12 and IC13. The positive peak of the sinewave is sampled by the analog switch IC12, the switch is controlled by the comparator IC14 and monostable IC15.

The output from the sampled and hold circuit is scaled and fed to the low distortion opto-isolator. Capacitor C67 ensures stability on the 10Hz-100Hz frequency range, and thermistor TH1 provides temperature compensation for the opto-isolator. The preset variable resistor PR10 calibrates the output amplitude.

The frequency of oscillation is determined by the value the dual potentiometer VR10 and the integrator capacitors. Frequency ranges are selected by the pushbutton switches SW7 to SW10.

Squarewaves are generated by the switched gain polarity amplifier IC16 and part of IC12. PR20 provides a reference voltage for calibration of the squarewave amplitude.

The sine and squarewave signals are passed to the output amplifier IC18 via the Sine/Square select switch SW1. VR20 is the Amplitude control. The output amplifier buffers the signal and feed it to a 600Ω constant impedance attenuator network. One of the poles of the 2-pole switches SW3-SW6 select the attenuation ratios of 0dB, -20dB and -40dB. The attenuated output is fed to the front panel BNC connector.
The second pole of the attenuator switches perform the Attenuator Select function for the microcontroller circuitry.

The output amplitude is measured by the sample and hold circuit IC17 and part of IC12. Monostable IC15 and IC19 provide the correct timing and control of the sample and hold circuit. The output from the sample and hold circuit is sent to the Amplitude input of the microcontroller circuitry.

A TTL compatible signal at the same frequency of the oscillator is generated by the comparator buffered by part of IC19 and sent to the Frequency input of the microcontroller circuit.

SW1(C) provides the Sine/Square select output to the microcontroller circuit.

Microcontroller and PSU Section

The microcontroller circuit measures the frequency and amplitude of the oscillator output and displays the results on the 2x16 line LCD module.
Frequency measurement is done by IC1's two internal 16-bit timer counters. The Frequency input is fed into pin 13 of IC1. The TTL compatible Frequency signal also provides the rear panel TTL output. R105, R119, R120 and ZD2 provide protection against voltages applied to the TTL output. The Amplitude signal from the oscillator circuit is fed to the microprocessor's internal 8-bit A/D converter via R103, PR2 and R104. PR2 provides full scale amplitude calibration. ZREF is the A/D reference voltage.

Port 2 of IC1 monitors the state of the attenuator and the Sine/Square select switch.

The microcontroller controls the LCD module via Port 5. Resistors R112 to R118 reduce the rise time of the signals output from Port 5, this reduces radiated interference from the microcontroller. PR1 provides contrast adjustment for the LCD module.

D1, R101 and C101 provide the power on reset delay for IC1.

Three d.c. power rails are generated by the power supply circuitry. The outputs from the isolating mains transformer T1 are rectified, smoothed and regulated to generated +5V and +/-15V. VSW1 is the mains voltage selection switch.

DISASSEMBLY.

Ensure that the mains supply and all external connecting leads are removed from the LDO100.

TOP COVER

- Turn the instrument upside down.
- Remove the stand by pushing firmly inwards on one side.
- Remove the four recessed retaining screws in the feet of the unit.
- With the instrument upright, carefully remove the top cover.

BOTTOM COVER

- Remove the top cover.
- Gently remove the side extensions that separate the top and bottom covers.
- Remove the two retaining screws that secure the main PCB to the bottom cover.
- Carefully lift the entire assembly, including the front and rear panels, from the bottom cover.

RE-ASSEMBLY.

To re-assemble the LDO100 follow the reverse of the dis-assembly instructions above.

VOLTAGE SELECTION

Ensure the mains supply lead is removed from the instrument before proceeding.

110 - 120VAC Supply

Use a flat bladed screwdriver of a suitable size, or a small coin. Apply slight inward pressure and rotate the voltage selection switch anticlockwise; the slot should line up with the 110 - 120VAC marking printed on the panel.

220 - 240VAC Supply
Use a flat bladed screwdriver of a suitable size, or a small coin. Apply slight inward pressure and rotate the voltage selection switch clockwise; the slot should line up with the 220 - 240VAC marking printed on the panel.

CALIBRATION.

Note. To ensure maximum accuracy calibration should be carried out at an ambient temperature of 20°C +/-1°C, after allowing the LDO100 to warm up for at least 30 minutes.

1. Set the output frequency to 1.00kHz, use the 1K range.
2. Set the LDO100 to sinewave.
3. Set the Attenuator to 0dB and the Amplitude to maximum.
4. Connect the wideband voltmeter to the main output BNC connector.
5. Carefully adjust PR10 to give a reading of exactly 5.30V rms on the wideband voltmeter.
6. Carefully adjust PR2 until the LDO100 LCD displays 5.29-5.31V rms.
7. Set the LDO100 to squarewave.
8. Carefully adjust PR20 to give a wideband voltmeter reading of 7.50V rms exactly.
9. Check the LDO100 LCD is displaying 14.9 - 15.1V p-p.

Calibration is now complete.

SPECIFICATION CHECK.

After repairing or calibrating the LDO100, the performance should be checked to ensure compliance with its specification.

1. Frequency Accuracy
   Connect the frequency counter to the rear panel TTL output of the LDO100. Set the LD100 to display a frequency of 1.00kHz. Check that the frequency counter reads 1.00kHz +/-1%.

2. Frequency Coverage
   Rotate the Frequency control from minimum to maximum and check each frequency range is adequately covered as shown below.

Frequency Range	Displayed Frequency
100	<10Hz to >100Hz
1K	<100Hz to >1kHz
10K	<1kHz to >10kHz
100K	<10kHz to >100kHz

3. Distortion Test.
   Select sinewave, set the Attenuator to -10dB and set the Amplitude control to maximum.
   Using the distortion analyser check the sinewave distortion is within the specified limits at the following frequencies.

Frequency	Max allowable THD + noise
10Hz	0.02%
1kHz	0.003%
10kHz	0.003%
100kHz	0.02%

4. Output Voltage Accuracy

(a). Select sinewave, connect the LDO100 output to then wideband voltmeter (Note. The voltmeter input impedance should be set to 600Ω +/-1%).

(b). Set the output frequency to 1kHz.

(c). Set Attenuator to 0dB and the Amplitude control to maximum. Check the LDO100 display and the voltmeter readings agree to within 1%.

(d). Set the Attenuator to -10dB. Check the LDO100 display and the voltmeter readings agree to within 1%.

(e). Set the Attenuator to -20dB. Check the LDO100 display and the voltmeter readings agree to within 1%.

(f). Set the Attenuator to -30dB. Check the LDO100 display and the voltmeter readings agree to within 1%.

(g). Set the Attenuator to -40dB. Check the LDO100 display and the voltmeter readings agree to within 1%.

PARTS LIST

ADDENDUM

Engineering change note: 382
As from Serial Number 52826 all LDO100's incorporate the following changes:-

1) IC1 is changed from a ST90R30(24-147) to either a ST90T30/40 (24-210/211).
2) IC2 74LS574(24-155) is removed.
3) IC3 27C256(24-144) is removed.
4) XTAL is changed from 12MHz(25-015) to 6MHz(25-008).
5) C106(20-020) is removed.
6) C107(20-020) is removed.
7) IC socket(14-004) is removed.

Engineering change note: 384
As from Serial Number 52826 all LDO100's incorporate the follwing changes:-

1) The I.E.C mains socket (14-017) is replaced with and I.E.C socket with integral E.M.I filter (17-016)

MAIN PCB ASSEMBLY

CIRCUIT POSITION			PART No.
R101	100K	0.25W MF 1%	18-058
R102	510R	0.25W MF 1%	18-219
R103	3K3	0.25W MF 1%	18-176
R104	3K0	0.25W MF 1%	18-060
R105	4K7	0.25W MF 1%	18-051
R106	1K	0.25W MF 1%	18-046
R107	1K	0.25W MF 1%	18-046
R108	1K	0.25W MF 1%	18-046
R109	1K	0.25W MF 1%	18-046
R110	1K	0.25W MF 1%	18-046
R111	1K	0.25W MF 1%	18-046
R112	4K7	0.25W MF 1%	18-051
R113	4K7	0.25W MF 1%	18-051

R114	4K7	0.25W MF 1%	18-051
R115	4K7	0.25W MF 1%	18-051
R116	4K7	0.25W MF 1%	18-051
R117	4K7	0.25W MF 1%	18-051
R118	4K7	0.25W MF 1%	18-051
R119	120R	0.25W MF 1%	18-042
R120	47R	0.25W MF 1%	18-234
LK	Zero ohm link (19)		18-061
R10	4K7	0.25W MF 1%	18-051
R11	910	0.25W MF 1%	18-117
R12	4K7	0.25W MF 1%	18-051
R13	910	0.25W MF 1%	18-117
R14	10K	0.25W MF 1%	18-054
R15	8K2	0.25W MF 1%	18-136
R16	3K9	0.25W MF 1%	18-050
R17	20K	0.25W MF 1%	18-115
R18	1K8	0.25W CF 5%	18-023
R19	24K	0.25W MF 1%	18-236
R20	27K	0.25W MF 1%	18-220
R23	2K2	0.25W MF 1%	18-067
R24	560	0.25W MF 1%	18-222
R25	100K	0.25W MF 1%	18-058
R26	820R	0.25W MF 1%	18-132
R27	2K2	0.25W MF 1%	18-067
R28	10K	0.25W MF 1%	18-054
R29	10K	0.25W MF 1%	18-054
R30	10K	0.25W MF 1%	18-054
R31	10K	0.25W MF 1%	18-054
R32	10K	0.25W MF 1%	18-054
R33	1K	0.25W MF 1%	18-046
R34	2K2	0.25W MF 1%	18-067
R37	10K	0.25W MF 1%	18-054
R38	1K	0.25W MF 1%	18-046
R39	604R	0.1% MF 0.125W	18-226
R40	1K21	0.1% MF 0.125W	18-229
R41	5K36	0.1% MF 0.125W	18-232
R42	576R	0.1% MF 0.125W	18-225
R43	1K62	0.1% MF 0.125W	18-230
R44	1K69	0.1% MF 0.125W	18-231
R45	1K15	0.1% MF 0.125W	18-228
R46	1K69	0.1% MF 0.125W	18-231
R47	1K15	0.1% MF 0.125W	18-228
R48	1k69	0.1% MF 0.125W	18-231
R49	787	0.1% MF 0.125W	18-227
R55	10K	0.25W MF 1%	18-054
R56	10K	0.25W MF 1%	18-054
R57	10K	0.25W MF 1%	18-054
R58	10K	0.25W MF 1%	18-054
R59	10K	0.25W MF 1%	18-054
R60	6K8	0.25W MF 1%	18-052
R61	4K7	0.25W MF 1%	18-051
R62	4K7	0.25W MF 1%	18-051
R63	4K7	0.25W MF 1%	18-051
R64	47R	0.25W MF 1%	18-234
R65	47R	0.25W MF 1%	18-234
R66	3M3	0.25W MF 1%	18-235
R67	1K	0.25W MF 1%	18-046
R68	10K	0.25W MF 1%	18-054
L1	330uH Inductor		17-009
PR1	10K preset		19-012

PR2	470R cermet preset	19-017
PR10	1K cermet preset pot	19-046
PR20	1K cermet preset pot	19-046
VR10	10K Pot 91R2AR22H15H15	19-044
VR20	10K Pot 91R1AR22E15	19-045
C101	470n 63V polyester	20-073
C102	27p 63V ceramic plate	20-049
C103	27p 63V ceramic plate	20-049
C104	100n 25V ceramic disk	20-020
C105	10u 16V tantalum	20-041
C106	100n 25V ceramic disk	20-020
C107	100n 25V ceramic disk	20-020
C108	100n 25V ceramic disk	20-020
C109	100u 16V electrolytic	20-005
C110	100n 25V ceramic disk	20-020
C111	100n 25V ceramic disk	20-020
C112	2200u 16V electrolytic	20-102
C113	470n 63V polyester	20-073
C114	100n 25V ceramic disk	20-020
C115	1000u 40V electrolytic	20-084
C116	470n 63V polyester	20-073
C117	100n 25V ceramic disk	20-020
C118	1000u 40V electrolytic	20-084
C119	470n 63V polyester	20-073
C120	100n 25V ceramic disk	20-020
C121	100p 63V ceramic	20-015
C10	1u5 63V 5% polyester	20-161
C11	100n 63V 5% polyester	20-167
C12	150n 63V 5% polyester	20-168
C13	10n 63V 5% polyester	20-165
C14	15n 63V 5% polycarbonate	20-166
C15	Not used	
C16	1n5 63V 5% polypropylene	20-164
C17	100p 63V 5% polypropylene	20-162
C18	100p 63V 5% polypropylene	20-162
C19	1n5 63V 5% polypropylene	20-164
C20	Not used	
C21	15n 63V 5% polycarbonate	20-166
C22	10n 63V 5% polyester	20-165
C23	150n 63V 5% polyester	20-168
C24	100n 63V 5% polyester	20-167
C25	1u5 63V 5% polyester	20-161
C26	100n 25V ceramic disk	20-020
C27	100n 25V ceramic disk	20-020
C28	100n 25V ceramic disk	20-020
C29	100n 25V ceramic disk	20-020
C30	1n 30V polystyrene	20-021
C31	100n 25V ceramic disk	20-020
C32	100n 25V ceramic disk	20-020
C33	10u 16V tantalum	20-041
C34	Not used	
C35	100n 25V ceramic disk	20-020
C36	100n 25V ceramic disk	20-020
C37	100p 63V ceramic plate	20-015
C38	10u 16V tantalum	20-041
C39	100n 25V ceramic disk	20-020
C40	100n 25V ceramic disk	20-020
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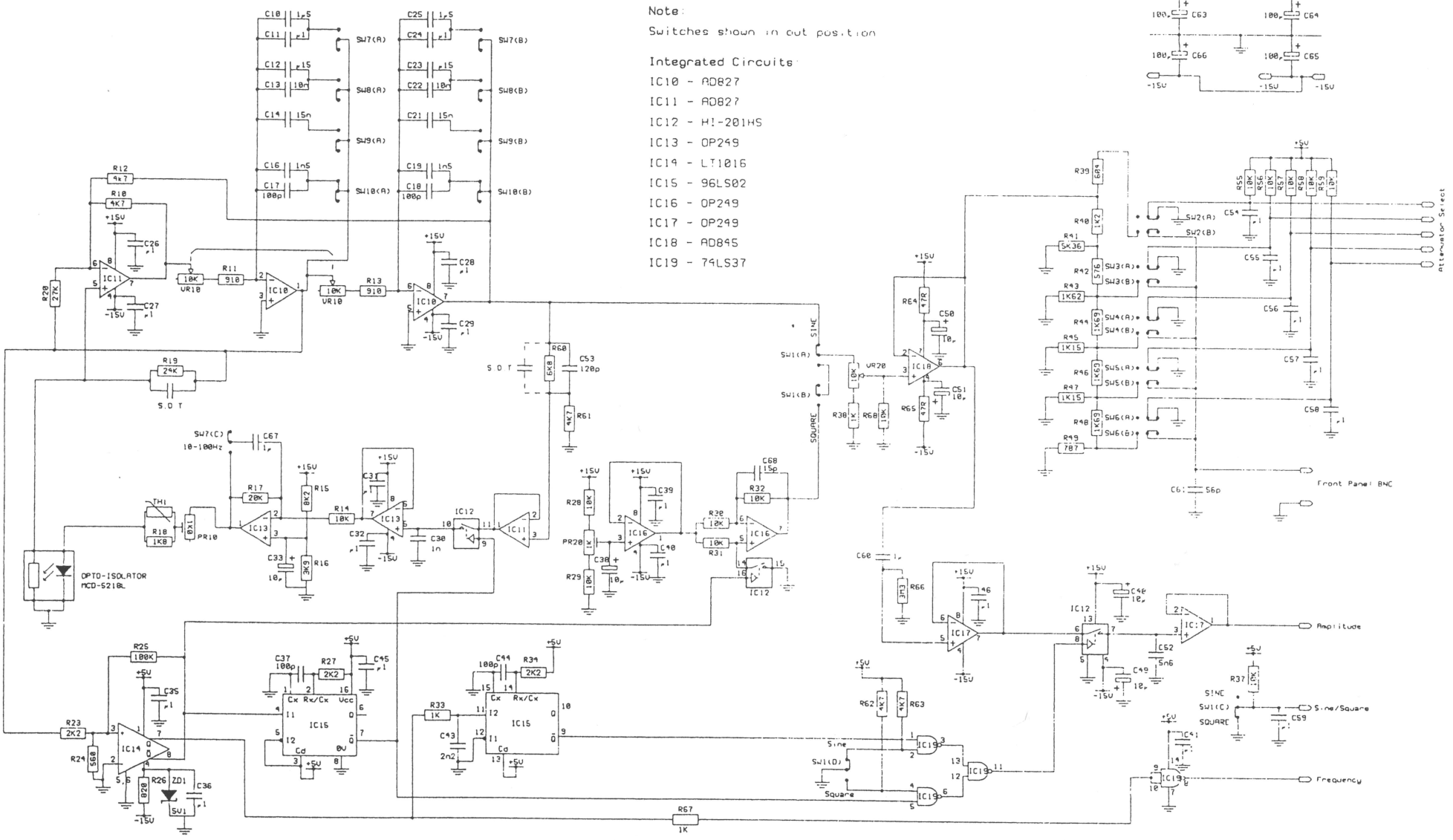
CIRCUIT DIAGRAMS AND COMPONENT LAYOUT

drawing no. LDO100/SCH | projection



issue code-provisional ABC etc/production 123 etc		
4	10/12/92	PRODUCTION

LDO100
OSCILLATOR CIRCUIT DIAGRAM

general information
do not scale/dimensions in mm
tolerances +/- angles +/-
general draft
unspecified radii
geometric tolerances to BS 308
remove all burrs and sharp edges

material:
finish:

disk file (BoardMaker)
LDO100 SCH - sheet 1
LDOMCU SCH - sheet 2

drawn	date	checked	scale
W.HAYLOCK	12 DEC 92	W.HAYLOCK	

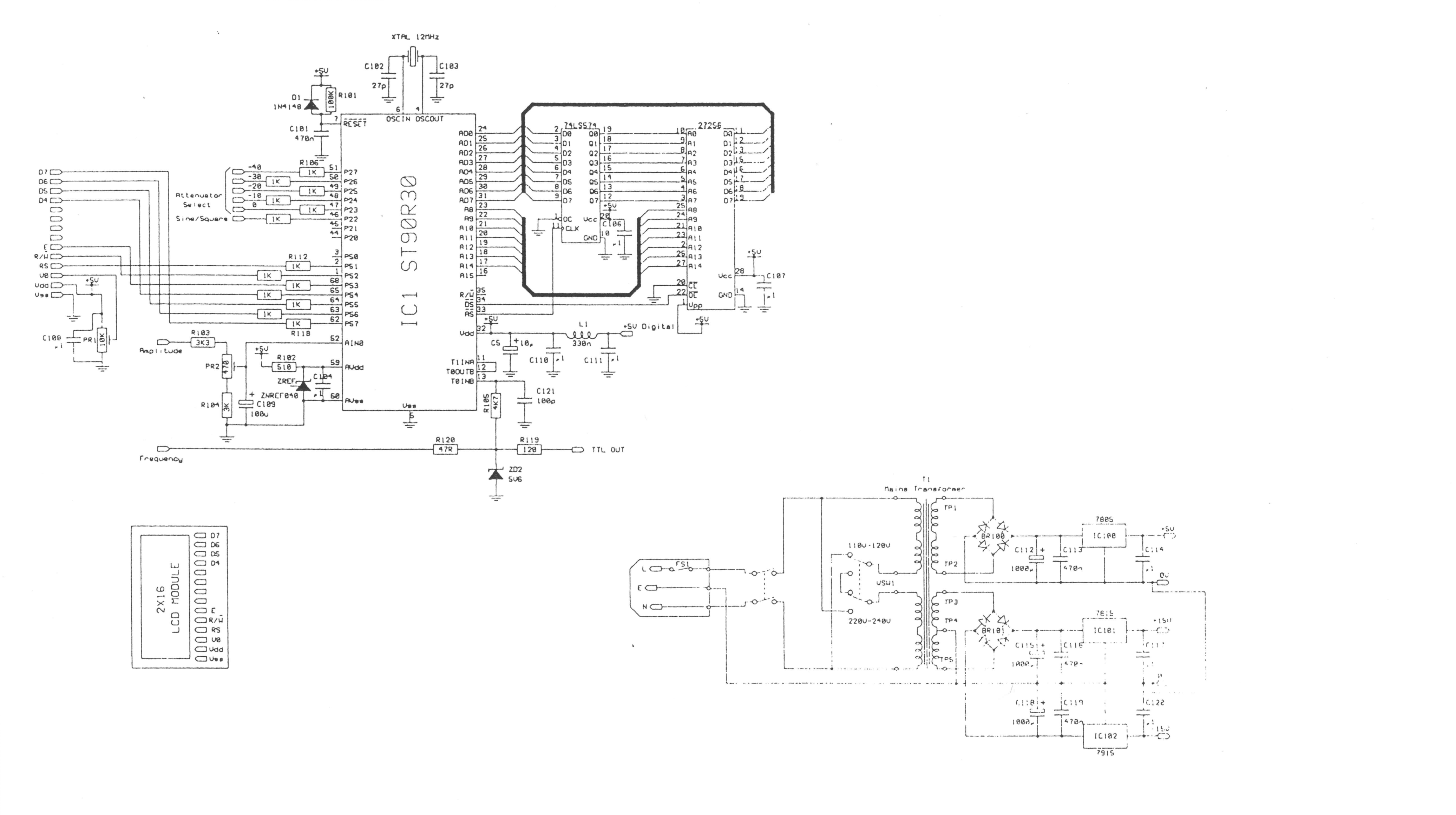
title: LDO100
OSCILLATOR CIRCUIT DIAGRAM

drawing no: LDO100/SCH

sheet	issue
1 of 2	4

drawing no. LDOMCU/SCH

projection



issue	date	code-provisional ABC etc/production 123 etc
4	10/12/92	PRODUCTION

LDO100

MICROCONTROLLER AND PSU CIRCUIT DIAGRAM

general information
do not scale/dimensions in mm
tolerances +/- angles +/-
general draft
unspecified radii
geometric tolerances to BS 308
remove all burrs and sharp edges

material

finish

disk files: (BoardMaker)
LDOMCU.SCH - sheet 2
LDO100.SCH - sheet 1

drawn	date	checked	scale
W HAYLOCK	10 DEC 92	W HAYLOCK	

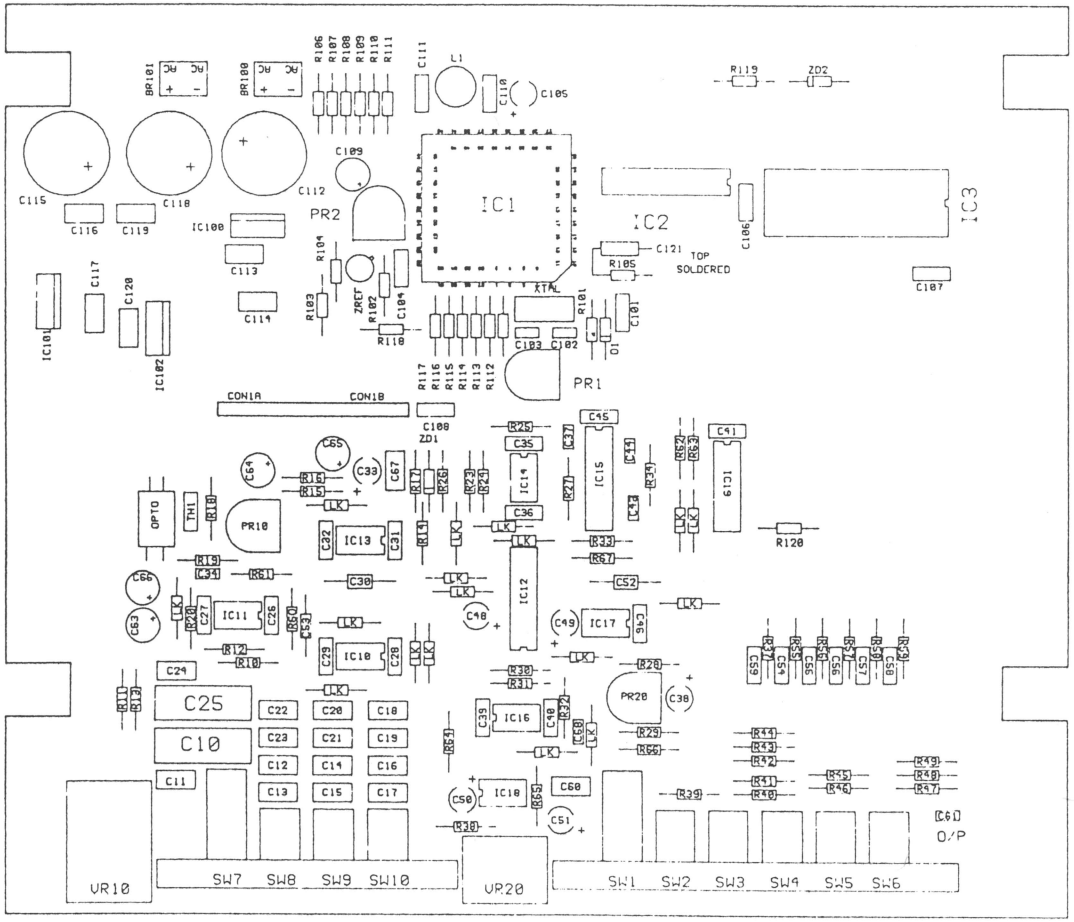
title LDO100 MICROCONTROLLER AND PSU CIRCUIT DIAGRAM

drawing no LDOMCU/SCH

sheet 2 of 2

issue 4

drawing no.	projection
LDO100/PCB	



issue code-provisional ABC etc/production 123 etc							
4	18/10/92	PRODUCTION	LDO100 COMPONENT LAYOUT	general information: do not scale/dimensions in mm; tolerances +/- ; angles +/- ; general draft; unspecified radii; geometric tolerances to BS 308; remove all burr and sharp edges	material	drawn: W.HAYLOCK	date: 10/12/92	checked: W.H.	scale
					finish	title: LDO100 COMPONENT LAYOUT			
				disk file: ldo100.pcb (BoardMaker)		drawing no: LDO100/PCB		sheet 1 of 1	issue 4