MUSTANG
COMMUNICATIONS

MACRO SYSTEM
SL/10 LINE SURVEILLANCE UNIT

INSTALLATION, COMMISSIONING & MAINTENANCE HANDBOOK

Issue No.6

SCOPE OF THIS ISSUE:

SL/10 - black fascia version

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CE Electromagnetic compatibility (EMC) directive 89/336/EEC and amendment directive 92/31/EEC

This equipment has been designed and manufactured to the highest standards. If connected and operated as set out in this manual, there should be no Electromagnetic Compatibility problems. If any aspect of operation gives rise to concern, then please contact the manufacturer for advice.

INTRODUCTION

Thank you for purchasing this unit. We are confident that you have made a wise decision, and that you will have many years of trouble-free operation. Considerable care has been taken during the design and manufacturing processes to ensure your entire satisfaction and naturally, we would hope that the unit will perform to our design expectations, though this will be possible only if the installation is in line with professionally accepted standards and techniques.
This manual is intended, therefore, to ensure that both the installer and operator have all the necessary information to enable them to install, commission, and operate the unit in the most effective manner. We hope you will find the manual helpful, and easy to read.

The Company and its quality statement

Mustang Communications, is the manufacturing mark of equipment manufactured by Mustang Communications Limited, of Scarborough, England. The company is independent, wholly British, and dedicated to the manufacture and distribution of high-reliability, high performance public address and associated control equipment. Mustang Communications was first registered in 1966, in England.
The Company undertakes to manufacture equipment to the highest standards of workmanship and performance. Our Quality Assurance scheme operates to, or exceeds, the standards set out in British Standard BS.5750, Part 2. 1987 or European standard ISO.9002. If you have cause to doubt at any time that the manufacture, or distribution does not comply, then you are invited to write to us with your comments, which will be most welcome.
Please address your correspondence to The Engineering Director.

The MACRO system concept and applications

MACRO System is a comprehensive range of AC mains and AC mains/24V DC amplification, controls and surveillance units and associated peripherals, designed for use by emergency services and high integrity communication and alarm systems, manufactured to the highest standards of electronic and mechanical performance and with Quality Assurance to British Standard BS.5750 AC/DC equipment is designed to operate normally from 220/240V AC mains, with the capability to operate indefinitely, and without loss of any facilities, from a standby DC power source (battery system) in the event of mains failure.
Full compatibility within the MACRO range is assured, thus easing system design and enabling fully integrated systems to be specified using standard MACRO components and options.

MACRO SYSTEM LINE SURVEILLANCE UNITS - general description

The SL/10 is a 10 circuit rack mounting controller whose purpose is to monitor the current flowing in a loudspeaker circuit resulting from the injection of a steady, coded signal at an early point within the amplification chain. The steady current is taken through two comparator circuits to monitor over-current and under-current situation. The allowable deviation from the steady state can be adjusted for at the commissioning stage within limits appropriate to the installation. Should a fault occur in the loudspeaker system which is sufficient to trip the comparator, the circumstances are registered by relay, LED and buzzer. The unit is adjusted for each loudspeaker line and front lamps identify and indicate overload or underload.
In a similar manner, should the amplifier fail in such a way that the surveillance signal does not reach the SL/10, this fact is also registered by the front LED's which flash alternately for the input channel(s) effected. This fault condition also switches the fault relay contacts, and simultaneously provides an independent trigger signal.

Mechanically the MACRO SL/10 surveillance units utilise a robust ventilated steel casing, powder coat painted, and screen printed, with nut and bolt fastenings throughout. Connectors are tough IEC mains, and military specification 97 series DC input, barrier terminals for audio input and output, and D connector for and Auxiliary control signals.
By use of the optional extra BKR-30 rack mount kit, the front fascia is converted to fit a standard 3U 19" panel space.
The SL/10 it designed to be fitted at the amplifier cubicle, with circuits inserted in each of the outgoing loudspeaker lines, thus requiring standard specification two-conductor cabling.

GENERAL SPECIFICATIONS

100V circuit capacity	10 independently monitored circuits
Audio input configuration	Fully floating, free of earth and isolated
Load range	25 Watts to 400 Watts per channel, in four switch selectable ranges
Maximum combined load	1500W RMS distributed across ten channels.
Detection resolution	± 10%, 20% and 30%
Operating frequency	20kHz +/- 100Hz
Pilot tone operating level	2V RMS superimposed on the 100V line
Load fault indication	LED display of OVERLOAD and UNDERLOAD
Load fault alarm output	One set isolated 1A change-over contacts
Insertion loss	Negligible
Amplifier fault threshold	500mV of surveillance pilot tone
Amplifier fault indication	Flashing LED's
Amplifier fault alarm output	Isolated 1A change-over contacts as above,
Amplifier fault trigger output	Current sink of up to 5mA per channel from positive source up to 15V DC. Goes low on fault detection.
AC supply requirements	220-240V AC (215-250V) 50-60Hz 6VA
DC supply requirements	24V DC (20-30V) 50mA basic plus 15mA per energised channel.
Supply failure alarm outputs	Individual 1A relay contacts for AC and DC supplies. Contacts normally closed when unit energised and supplies intact.
Remote buzzer switch requirement	Momentary, 1mA @ 15V
Audio line connections	M3.5 (4BA) barrier terminal for spade or ring terminals
Auxiliary connector	25 pin D. Female on rear panel.
AC supply connector	Standard 6A 3pin IEC (supplied)
AC supply fuse	500mA anti-surge fuse. 20mm
DC connector	MIL type 97. 3pin (supplied)
DC supply fuse	1A fast. 20mm
Dimensions	Standard 3U rack mount by use of optional BRK-30 kit.

FACTORY FITTED OPTIONS

No options are available on the standard SL/10, though we will be pleased to consider the incorporation of further features at subsequent design reviews.

UNIT OPERATION

In operation, the SL/10 monitors an inaudible surveillance signal which will be present on all loudspeaker lines which are being powered from amplifiers which are part of a planned Mustang surveillance system. Characteristics of the monitored signal will change in the event of a load change (error) and if the changes exceeds pre-set acceptable limits, a front panel LED illuminates to indicate an overload or underload. If the surveillance signal fails as a result of amplifier problem or interconnection fault etc., then both lamps will flash alternately.

For the duration of an LED being illuminated, a set of dry-loop relay contacts change-over to provide an outgoing alarm trigger. Upon triggering of the LED, an internal buzzer will sound, but this may be cancelled by momentary use of the front panel reset button. The relay contacts are not cancelled. Upon repair of the loudspeaker fault, the LED will extinguish, and this will automatically cancel the buzzer.

The operation of both the amplifier failure, and loudspeaker line monitoring functions are delayed for a few seconds in order that false triggering is avoided. Short fault transients are thus disregarded.

The SL/10 utilises a three pole power control circuit which operates in the AC Live, AC Neutral, and +24V DC input lines simultaneously. Both AC and DC power supply integrity is monitored and individual dry-loop relay contacts are presented at the rear D connector. These contacts are closed when the PSU's are intact.

For system expansion, a trigger signal is also presented at the D connector, originating in the amplifier sensor circuitry for each channel. These light duty current sinks may be used externally in an automated amplifier change-over system.

A stabilised power regulator system ensures a high degree of monitoring stability.

For more extensive systems, possibly using several SL/10 units, the buzzer function may be provided by a central Alarm Annunciator Panel, in which case the buzzer of the SL/10 may be disabled - see "Muting the buzzer". This function is also useful during initial setting up of the SL/10 internal adjustments. Similarly, unused channels may be switched off internally, to cancel irrelevant LED indications.

CONNECTING THE UNIT TO LOUDSPEAKER LINES

The SL/10 is designed for 100V line loudspeaker operation only. The load detection circuits are intended to be inserted in each loudspeaker line, preferably close to the related amplifier. Two rear screw terminals are provided for termination of the outgoing loudspeaker feeds.

For maximum effectiveness, the outgoing loudspeaker lines should be free of earth.

CONNECTING THE UNIT TO THE AMPLIFICATION SYSTEM

The SL/10 is designed for use with 100V line amplification only, using amplifiers which are permanently carrying the inaudible surveillance pilot tone. It is vital that there is no variation in this signal level, and therefore, zone volume controls may not be used at this point in the signal chain.
All the audio input circuitry is floating free of earth, and there is complete electrical isolation between the 10 channels.
It is perfectly permissible to combine input circuits so that one amplifier may drive several monitored loudspeaker lines. Jumper links may be connected across the appropriate rear terminals.
For maximum effectiveness, the incoming amplification lines should be free of earth.

AUXILIARY CONNECTIONS

A rear panel mounted female 25 pole D connector provides all the alarm output connections. None of these need to be connected for the SL/10 to operate as a simple stand-alone detection system.

CONNECTION PIN	FUNCTION
1	Channel 1 5mA current sink during amplifier fail
2	Channel 2 5mA current sink during amplifier fail
3	Channel 3 5mA current sink during amplifier fail
4	Channel 4 5mA current sink during amplifier fail
5	Channel 5 5mA current sink during amplifier fail
6	Channel 6 5mA current sink during amplifier fail
7	Channel 7 5mA current sink during amplifier fail
8	Channel 8 5mA current sink during amplifier fail
9	Channel 9 5mA current sink during amplifier fail
10	Channel 10 5mA current sink during amplifier fail
11	0V for general purpose
12	nc
13	AC mains PSU failure. Contacts normally open on failure
14	
15	DC PSU failure. Contacts normally open on failure
16	
17	Normally open with power off — Alarm output change-over relay contacts
18	Common — Alarm output change-over relay contacts
19	Normally closed with power off — Alarm output change-over relay contacts
20	Remote control of buzzer reset function
21	Remote control of buzzer reset function
22	nc
23	nc
24	nc
25	nc

Amplifier failure current sink

Upon failure, for any reason, of any 100V line input signal arriving at the SL/10, the detection circuitry presents a light duty current sink to 0V on corresponding pins 1 to 10 above. 2.2k hold-up resistors are incorporated and the current should be limited to 5mA maximum per sink, derived from a +15V (maximum) source. This function is TTL/CMOS compatible and may be used to trigger an automated change-over system for replacing amplifiers, external fault indication, etc.

Alarm output contacts

Both the PSU fault contacts, and the alarm change-over relay contacts operate such that the relays are energised during normal system operation, changing over upon a fault occurring. PSU relay contacts break contact on fault occurring.

Remote control of buzzer

These contacts may be used to remotely cancel the buzzer from, for example, a nearby supervisory control console. Bridging the contacts momentarily will cancel the buzzer without disturbing the LED display. This function may be used to prevent the buzzer operating, by bridging the contacts permanently.
If the buzzer is found to be inoperative, check the Molex link on the PCB - see “Muting the buzzer” below. The link must be in place for the buzzer to work at all.

USER CONTROLS, ADJUSTMENTS & INDICATORS

By design, user accessible controls for the SL/10 are kept to a minimum to avoid inadvertent or unauthorised maladjustment which could render the system ineffective.
Front panel controls are limited to a Power on-off switch and the buzzer reset button.
Two yellow LED indicators per channel identify the nature of any fault occurring on that channel.

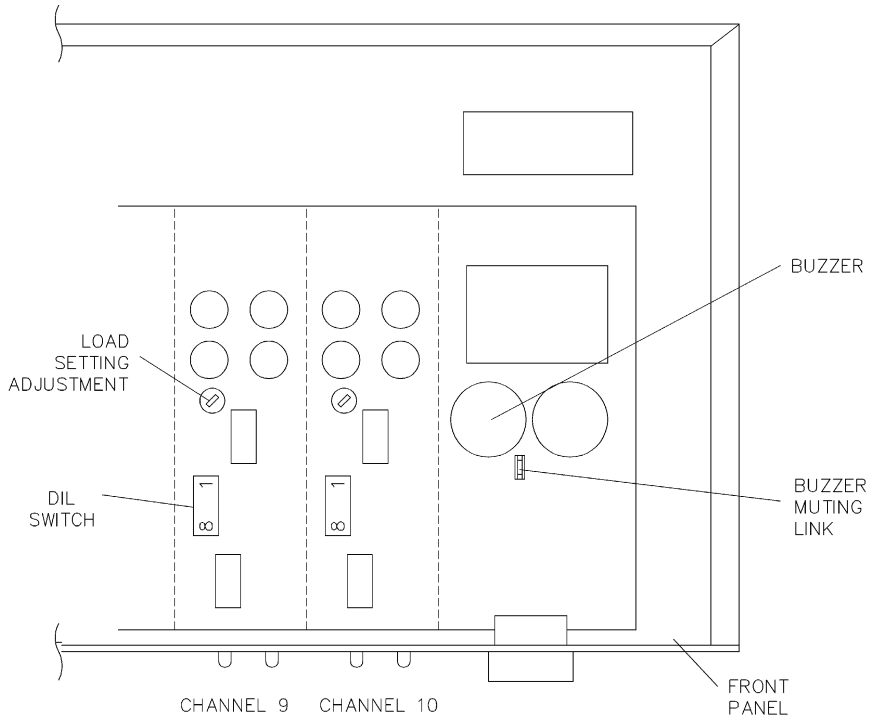


Fig. 1 Identification of adjustments and switches.

INTERNAL ADJUSTMENTS AND SETTINGS

To set the channels, it is necessary to switch on the associated surveillance amplification, and to have the appropriate loudspeaker load connected.

Setting up the circuits is particularly simple and requires no more equipment than a screwdriver. Each channel is provided with an 8 pole DIL switch, which controls various broad settings of the channel. A small trimmer is used for accurate load setting. These components are located behind the corresponding channel LEDs and may be identified by reference to Fig. 1.

To commission the channel, the following DIL switch functions must be addressed in order:

Channel on-off
Sensitivity range
Initial null switch setting, then use trimmer for accurate load setting.
Acceptable load deviation range

Channel on-off
As supplied from the factory, all channels are active. DIL switch position 5 controls the operation of each channel. To be active, the switch should be gently pushed to the ON position using a small screwdriver blade, ball-pen etc. When active, the channel will be able to operate the front LED's, and send trigger pulses to the collective alarm circuitry. Disable any unused channels with this switch.

Sensitivity Range
Loudspeaker loads between 25 and 400 Watts may be monitored on each channel, in four overlapping ranges. The system will have been configured with various loudspeaker lines of known loads. By reference to Table 1. on page 8, set the DIL switches 1 and 2 to an appropriate setting. For a variety of reasons, the expected/calculated load may differ from the actual load, so these settings may need to be adjusted later.

Null setting
Set switches 7 and 8 to the 'ON' position. In this mode, there is no leeway between the LED's indication changing from OVERLOAD to UNDERLOAD, thus enabling the use of the trimmer to set the load recognition precisely.
In the null setting, adjust the trimmer clockwise to recognise increased loads within the set range. At some point, the front LED's will snap over from UNDER to OVER or vice-versa. Note that there is a time lag on this adjustment, so a little patience will be required to set the trimmer as near as possible to the changeover point.

Acceptable Deviation Range
Theoretically, the SL/10 could have been designed to register extremely fine deviations, but in practice this would lead to a stream of false alarms resulting from unexpected load variations, even though the loudspeaker system were perfectly intact. Some possible causes are:-

Outdoor temperature variations effecting loudspeaker lines
Indoor heating systems effecting loudspeaker voice coil impedances and lines
Humidity and water ingress causing increased loads

Generally speaking, the more complex the line, or the longer the line, especially if outdoors, the more potential there is for false alarms. Similarly, if a long outdoor loudspeaker line carries only a small loudspeaker load, then the line variations could outweigh the required detection of the complete loss of one of the loudspeakers. Against this we must consider that a line of any length, but connecting many loudspeakers will be unable to register the loss of just one unit, as this load loss will represent just a small percentage load deviation.

The following is a list of load variation causes that would warrant a genuine alarm:

Increased load due to line short or partial short circuit
Increase/decrease due to loudspeaker voice coil or transformer failure
Increased load due to loudspeakers being re-tapped to a higher wattage
Reduced load due to loudspeaker failure or disconnection
Reduced load due to partial disconnection of line

So, as ever, we must resort to good professional practice based on sound engineering principles, supported by practical field experience. Our experience, indicates that a 10% deviation would be acceptable for shorter indoor lines, whilst 20% may be a good all-round figure. 30% would suit difficult exposed lines feeding a few large loudspeakers.
In extreme circumstances, it may be necessary to segregate, combine or split loudspeaker lines to achieve a practical monitoring configuration.

DIL switches 7 and 8 control the deviation symmetrically about the nominal load setting. See Table 1. for details.

DIL switch	1	2	5	7	8
LOAD RANGE (WATTS)					
20 - 60	ON	ON			
50 - 155	OFF	ON			
125 - 330	ON	OFF			
150 - 450	OFF	OFF			
CHANNEL					
ON			ON		
OFF			OFF		
LOAD DEVIATION LIMITS					
0				ON	ON
10%				OFF	ON
20%				ON	OFF
30%				OFF	OFF

Table 1. DIL Switch settings

Surveillance frequency
The frequency at which the MACRO surveillance amplification operates is factory set. The SL/10 is also factory adjusted to match the amplification, providing an appropriately selective bandwidth. Under no circumstances attempt to adjust the small red-topped inductors on the PCB. These are critically adjusted at the factory, and are permanent.

Muting the buzzer
The alarm buzzer may be cancelled by the front reset button as require. However, the SL/10 may be incorporated into a system featuring a dedicated alarm annunciator panel with its own buzzer. In this case, the buzzer may be muted permanently by removing/repositioning the Molex jumper link which is located adjacent to the buzzer on the PCB. The buzzer is the 20mm diameter black component with central hole, located adjacent to the power transformer.

LOUDSPEAKER CIRCUIT CHANGES
It may be necessary to alter loudspeaker arrangements for any given installation from time to time. The range of adjustment possible on the SL/10 is limited in absolute terms, to accommodate loads varying between 25 Watts and 400 Watts. If it is found that the connected load cannot be accommodated on the pre-set without the rotation being cramped at one end of the scale, it will be appropriate to select an alternative DIL switch combination.

AC & DC POWER SUPPLIES

AC Mains power input
A standard IEC 3 core cableset is supplied with each MACRO SL/10. It is essential that the safety Earth connection is made properly, as the chassis of the unit is earthed via this facility. The standard mains power required is 220 to 240V AC at 50-60Hz and the power requirement for the unit is minimal. The conductor colour codes are:

L	Live	Brown
N	Neutral	Blue
E	Earth	Grren/Yellow

Where the unit is to be powered from a two-wire AC supply, the rear screw terminal must be permanently connected to a suitable safety earth point. This terminal is indicated by the symbol -

DO NOT operate the unit under any circumstances without an electrical earth connected.

DC power input
The unit is designed to operate from 24V DC during periods of mains supply failure. It is permissible for this voltage to vary between 20V and 30V without undue problem. A MIL 97 series military style connector is supplied with each unit and the corresponding connections are printed alongside the panel connector, as follows;

Pin A **+**
Pin C **-** } 24V DC supply

Pin B Chassis only

Note that the DC connections are completely free of earth connection within the unit thus enabling either positive or negative earthed DC systems to be used.

Power supply change-over
This function is carried out automatically and instantaneously upon failure of the regular AC mains supply. There is no break in service and all facilities are retained for the duration of the condition. Upon reinstatement of the AC supply, the unit automatically reverts to AC operation.
The change-over process may be monitored - see below.

Power supply failure monitoring
Each supply energises a relay with light duty relay contacts and rear connections provide the facility to monitor the integrity of both the AC mains and DC standby supplies. The PCB mounted relays are normally energised when the unit is switched on, and the AC and DC supplies are connected, and will drop out as a result of :-

AC: AC supply failure
AC rear panel fuse failure
AC supply disconnection
Unit switched off
Internal AC PSU failure

DC: DC supply rear panel fuse failure
DC supply disconnection
DC standby supply failure
Unit switched off

These relay contacts may be used to trigger remote audible or visual alarms within the system to draw attention to a possible problem.

EARTHING AND HUM LOOPS

In designing the MACRO system, we have borne in mind that the applications for the equipment will generally be in large scale installations where there may be many conflicting requirements. Therefore MACRO unit chassis are always earthed via the AC power input cordset or by connection to the dedicated earth stud denoted:

THIS IS A SAFETY EARTH AND MUST NEVER BE DISREGARDED.

However, the electronic circuitry within the chassis is totally free of any earth connection enabling the most effective audio earthing arrangement to be incorporated at system design stage. The audio input lines are free of earth connection, and are totally isolated from each other.

MAINTENANCE

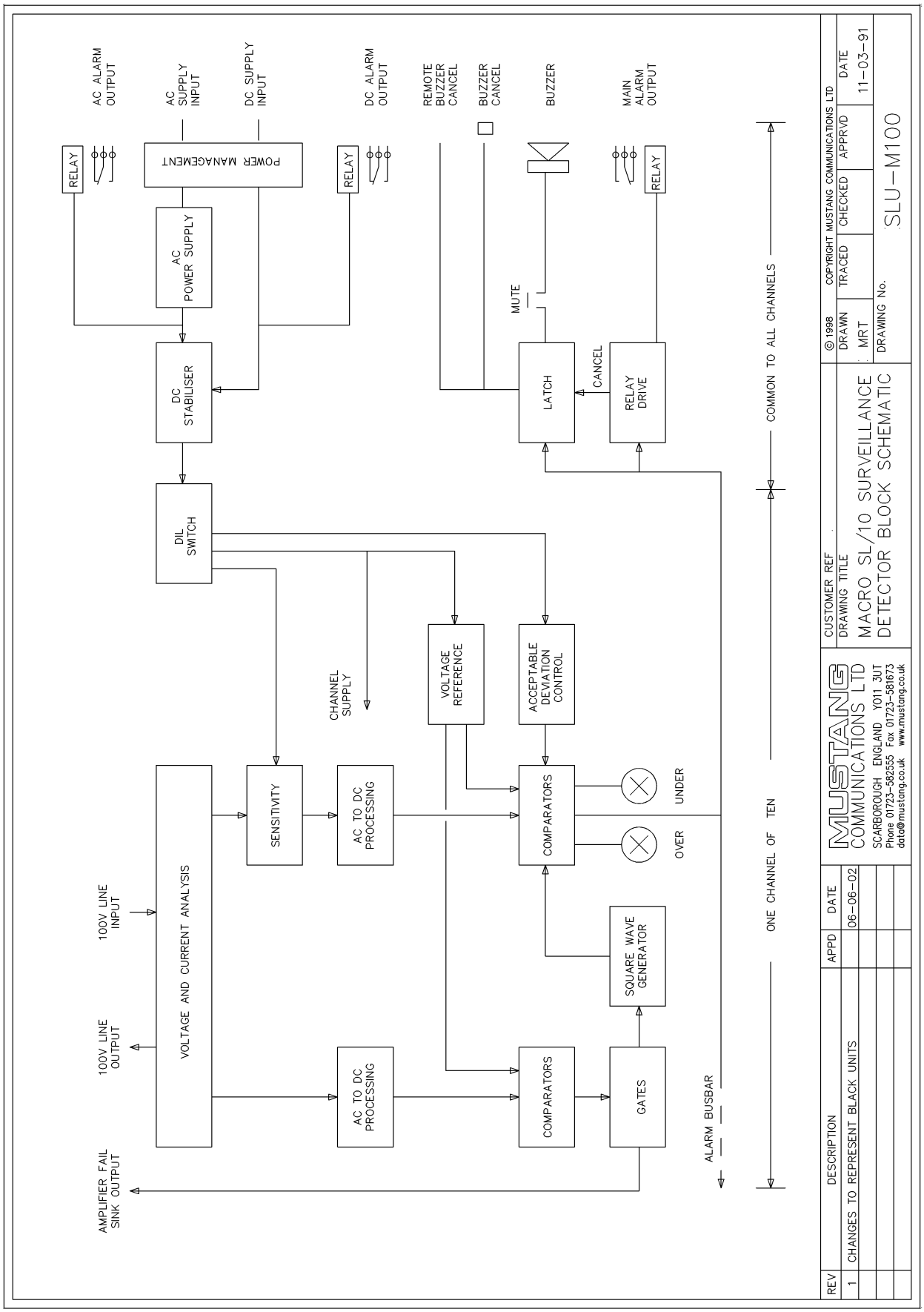
Very little useful preventive maintenance may be carried out on the SL/10.
Alarm relays are sealed units and therefore unlikely to suffer from tarnished contacts, though as with all relays, the contacts may be damaged by switching heavily inductive loads.

WARRANTY

This unit should operate successfully for many years if installed correctly. However, should any fault occur within 24 months of installation, irrespective of usage or application, the manufacturer undertakes to replace parts, or the whole unit, at their discretion, free of all labour or parts charges. However, should investigation of such a fault indicate operation of the unit outside its specification, then the manufacturer reserves the right to levy an appropriate repair charge.
Should a fault be suspected, your dealer should be notified in the first instance. All returns should be made via your dealer, forward carriage paid, and be accompanied by details of:

A The reported symptoms
B Brief details of the installation.
C Details of the circumstances of failure

Following the routine warranty period, Mustang equipment may be returned via your dealer, to the manufacturer for any necessary repairs or refurbishing. Details of the work required/reported fault must accompany the unit, and nominal charges will be levied.


AC ALARM OUTPUT
AC SUPPLY INPUT
DC SUPPLY INPUT
DC ALARM OUTPUT
REMOTE BUZZER CANCEL
BUZZER CANCEL
BUZZER
MAIN ALARM OUTPUT
RELAY
POWER MANAGEMENT
AC POWER SUPPLY
DC STABILISER
DIL SWITCH
MUTE
LATCH
CANCEL
RELAY DRIVE
CHANNEL SUPPLY
VOLTAGE REFERENCE
ACCEPTABLE DEVIATION CONTROL
100V LINE INPUT
100V LINE OUTPUT
VOLTAGE AND CURRENT ANALYSIS
SENSITIVITY
AC TO DC PROCESSING
COMPARATORS
UNDER
OVER
SQUARE WAVE GENERATOR
GATES
ALARM BUSBAR
AMPLIFIER FAIL SINK OUTPUT
COMMON TO ALL CHANNELS
ONE CHANNEL OF TEN
REV
DESCRIPTION
APPD
DATE
1 CHANGES TO REPRESENT BLACK UNITS
06-06-02
MUSTANG COMMUNICATIONS LTD
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Phone 01723-582555 Fax 01723-581673
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CUSTOMER REF
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MACRO SL/10 SURVEILLANCE
DETECTOR BLOCK SCHEMATIC
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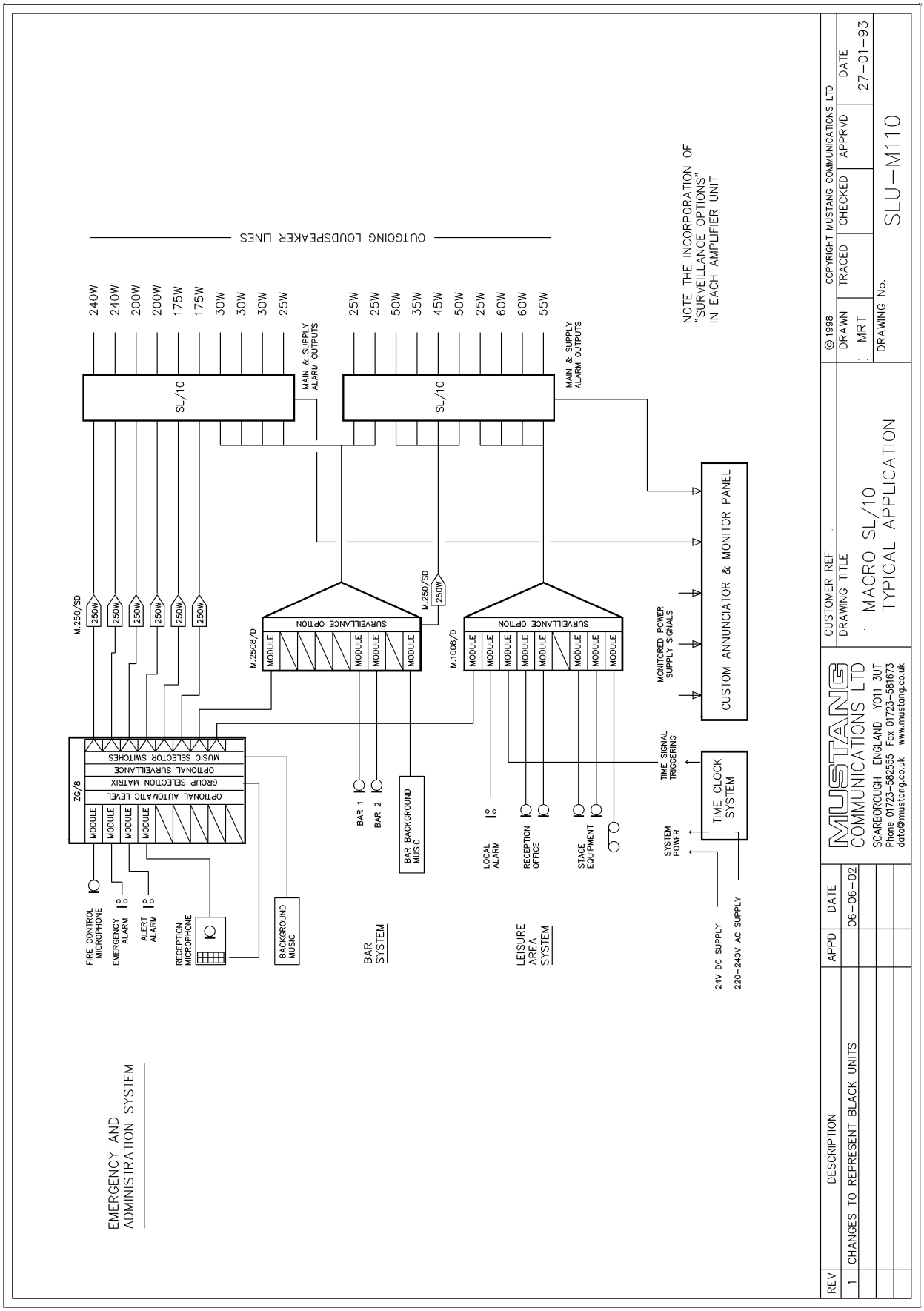
DATE 11-03-91
DRAWING No. SLU-M100


EMERGENCY AND ADMINISTRATION SYSTEM
OUTGOING LOUDSPEAKER LINES
240W 240W 200W 200W 175W 175W 30W 30W 30W 25W
25W 25W 50W 35W 45W 50W 25W 60W 60W 55W
MAIN & SUPPLY ALARM OUTPUTS
SL/10
SL/10
NOTE THE INCORPORATION OF "SURVEILLANCE OPTIONS" IN EACH AMPLIFIER UNIT
M.250/SD
M.2508/D
M.1008/D
SURVEILLANCE OPTION
MODULE
ZG/8
OPTIONAL AUTOMATIC LEVEL
GROUP SELECTION MATRIX
OPTIONAL SURVEILLANCE
MUSIC SELECTOR SWITCHES
CUSTOM ANNUNCIATOR & MONITOR PANEL
MONITORED POWER SUPPLY SIGNALS
TIME SIGNAL TRIGGERING
TIME CLOCK SYSTEM
SYSTEM POWER
24V DC SUPPLY
220-240V AC SUPPLY
FIRE CONTROL MICROPHONE
EMERGENCY ALARM
ALERT ALARM
RECEPTION MICROPHONE
BACKGROUND MUSIC
BAR 1
BAR 2
BAR BACKGROUND MUSIC
BAR SYSTEM
LOCAL ALARM
RECEPTION OFFICE
STAGE EQUIPMENT
LEISURE AREA SYSTEM
REV
DESCRIPTION
APPD
DATE
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CHANGES TO REPRESENT BLACK UNITS
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TYPICAL APPLICATION
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SLU-M110