

LCM MAX (Modular Analog eXpandable) System

The unit is housed in an aluminium enclosure, 120mm wide by 80mm high by either 220mm or 360mm in length, dependent on system complexity.

The unit is powered from either 100-240Vac, or 12-30Vdc.

A *motherboard* is fitted to the base of the enclosure and contains the power supply and a number of pcb headers. These are arranged to form a four way *channel bus*, four way *group bus*, three way *trip bus*, two way *aux bus*, and three way *power bus* which interconnect a variety of daughter boards (either *input*, *comparative output* or *quantitive output*) whose individual functions are outlined below.

Input Boards

MAX-010 Load Cell Input Board

MAX-020 Current Input Board

MAX-025 Instrumentation Board

Up to four input boards can be fitted to the system, together with a single **Summation Board (MAX-030)** and/or **8 Way Switching Board (MAX-035)**. These boards feed dedicated ways of the *channel* and *group busses* respectively.

Comparative Output Boards

MAX-080 Relay Output Board

MAX-100 Traffic Light Output Board

MAX-110 Ladder Output Board

Any number of these output boards can be fitted to the system to compare the voltages on the *channel* and *group busses* with those on the *trip bus*. Only a single **8 Level Trip Set Board (MAX-040)** may be fitted.

Quantitive Output Boards

MAX-050 Voltage Output Board

MAX-060 Current Output Board

MAX-070 Serial Output Board

MAX-090 Meter Output Board

Any number of these output boards can be fitted to the system to give numerical outputs relating to the voltages on the *channel* and *group busses*.

C(hannel) Bus

This carries voltages proportional to the signal applied to the corresponding *input board(s)*.

G(roup) Bus

For systems fitted with a MAX-030, this carries voltages proportional to the sum of the signals applied to the selected *input boards*.

For systems fitted with a MAX-035, this carries a voltage proportional to the signal applied to the remotely selected *input board*.

For systems fitted with neither a MAX-030 or MAX-035, this bus is unused.

T(rip) Bus

This carries voltages that are set on certain *output boards* (MAX-040, MAX-080, MAX-100, MAX-110). According to the system design, the voltages on the T2 and T3 bus may be entirely independent of the voltage on the T1 bus, or they may be pre-defined ratios thereof.

On some systems, the trip voltages set on certain *output boards* (MAX-080, MAX-110) may be localised and not routed to the T bus. In such systems, the trip voltage must be measured via the local on-board test point.

The voltages on the *trip bus* define the operation of the *comparative output boards*. In general, they set the levels at which relays energise (MAX-080), warning lights and buzzers operate (MAX-100) or led ladders reach full scale (MAX-110).

For systems fitted with none of the above *output boards*, this bus is unused.

A(uxiliary) Bus

This is for future development and is currently unused.

Power Bus

This carries the ± 12 Vdc supplies to all the daughter boards.

MAX Motherboard (PCB 5046)

Connections

- 1 Earth / 0Vdc
- 2 100-240Vac Neutral / No Connection
- 3 100-240Vac Live / 12-30Vdc fused 500mAT

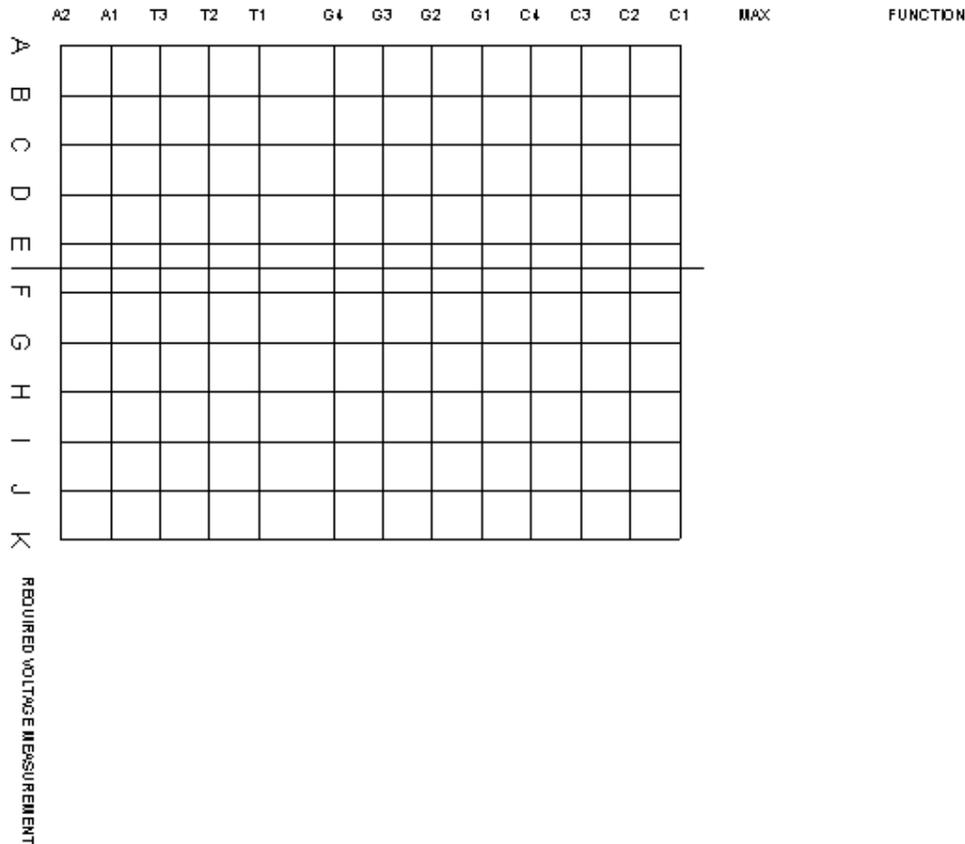
Configuration

An *input board* is normally adjusted to give an output of 0Vdc for no load, 8Vdc for full rated load on the load cell. The latter can be achieved by either applying known dead-weights or by switching the CAL switch ON, and extrapolating using the formula:-

required voltage = $8 \times (\text{cal load} / \text{full rated load})$

where cal load is either the known dead weight or the cal equivalent load, as applicable, and full rated load is that of the load cell.

In the diagram below, each dot represents a DIL switch in the ON position, thereby connecting that particular daughter board to the corresponding motherboard bus.



Specification

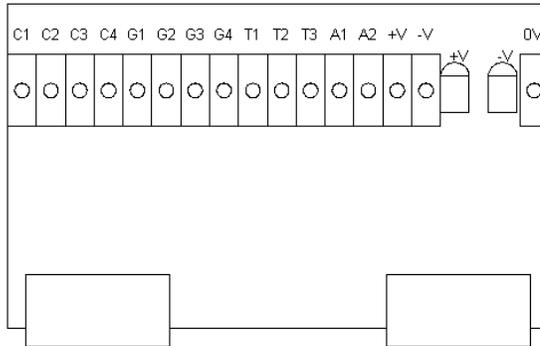
MAX	Supply	Daughter boards	Daughter board current
151	12Vdc	10 + Test Board	800mA
152	15-24Vdc	10 + Test Board	800mA
153	100-240Vac	10 + Test Board	400mA
154	100-240Vac	10 + Test Board	800mA
161	12Vdc	4 + Test Board	800mA
162	15-24Vdc	4 + Test Board	800mA
163	100-240Vac	4 + Test Board	400mA
164	100-240Vac	4 + Test Board	800mA

MAX Test Board (PCB 5057)

The Test Board has a series of test points which enable the voltages on the Motherboard busses to be measured. There are also leds to indicate the presence of the positive and negative power supply rails.

All measurements are made with respect to the 0V (black) test point.

The voltages on the +V and -V test points should respectively be +12Vdc and -12Vdc, $\pm 0.6V$. The voltages on the C, G, T and A bus will vary according to the Configuration section.



MAX-010 Load Cell Input Board (PCB 5047)

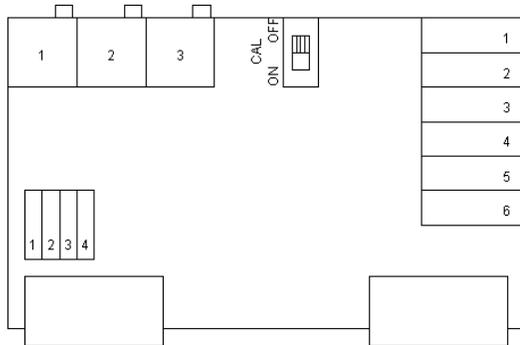
This board accepts either a standard 4 wire load cell, or a 6 wire load cell with integral calibration resistor.

The board provides 10Vdc bridge excitation and has an integral calibration resistor and switch.

Adjustments are for zero, coarse and fine gains.

The output of the amplifier is connected via a dil switch to any one channel.

The amplifier gain is normally set to give 8V at rated load.



Connections

- | | | |
|---|----------------------|-------------------------|
| 1 | +Signal | |
| 2 | -Signal | |
| 3 | -Excitation / Screen | |
| 4 | +Excitation | |
| 5 | +Excitation | (6 wire load cell only) |
| 6 | External Calibration | (6 wire load cell only) |

Controls

- | | |
|---|-------------|
| 1 | Fine Gain |
| 2 | Coarse Gain |
| 3 | Zero |

Channel DIL Switches

- 1-4 Selects to which channel bus the amplifier output is connected.
Select one and only one.

Setting Up

With no load on the pin and the CAL switch OFF, adjust the zero control for 0.00Vdc on the selected channel bus test pin.

Either by using a known dead weight or by using the CAL switch, adjust the coarse and fine gain controls to give the voltage specified in the Configuration section.

Re-check the zero condition and repeat as necessary.

Ensure the CAL switch is OFF when setting up is complete.

Specification

Input sensitivity for 8V on channel

0.2mV/V to 4.0mV/V, adjustable coarse & fine

Zero adjustment

±0.1mV/V

Bridge excitation

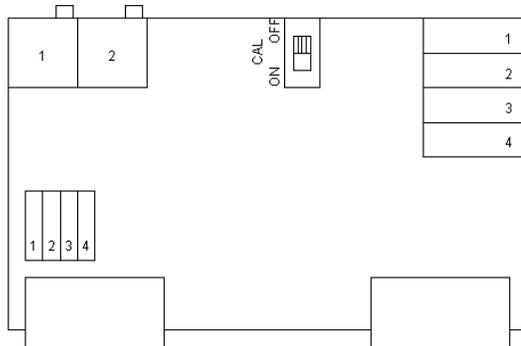
10Vdc @ 100mA

Current consumption

2mA + bridge current (28mA for 350Ω bridge)

MAX-020 Current Input Board (PCB 5055)

This board accepts the output from a loop current generator, such as the **LCM ICA**. The board provides a 12Vdc supply to the external generator and has an integral switch to activate the external calibration facility of the **LCM ICA**. Adjustments are for zero and gain. The output of the amplifier is connected via a dil switch to any one channel. The amplifier gain is normally set to give 8V for 20mA input.



Connections

- 1 +Signal
- 2 External Calibration (LCM ICA only)
- 3 -Signal / 0Vdc / Screen
- 4 +12Vdc

Controls

- 1 Fine Gain
- 2 Zero

Channel DIL Switches

- 1-4 Selects to which channel bus the amplifier output is connected. Select one and only one.

Setting Up

With no load on the load cell and the CAL switch OFF, adjust the zero control for 0.00Vdc on the selected channel bus test pin.

Either by using a known dead weight or by using the CAL switch, adjust the fine gain control to give the voltage specified in the Configuration section.

Re-check the zero condition and repeat as necessary.

Ensure the CAL switch is OFF when setting up is complete.

Specification

Input sensitivity for 8V on channel

18.2mA to 20.9mA, adjustable

Zero adjustment

±5mA

Aux. power supply

+12Vdc

Current consumption

12mA + aux. current (50mA for LCM ICA with 350Ω bridge at rated load)

MAX-025 Instrumentation Input Board (PCB 5056)

This board accepts either a standard 4 wire load cell, or a 6 wire load cell with integral calibration resistor, but with better performance than the **MAX-010**.

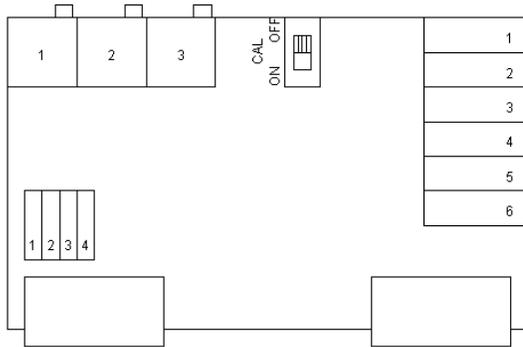
The board provides 10Vdc bridge excitation and has an integral calibration resistor and switch.

The board can be readily modified to accept a variety of other input sources, for example resistance.

Adjustments are for zero, coarse and fine gains.

The output of the amplifier is connected via a dil switch to any one channel.

The amplifier gain is normally set to give 8V at rated load, or at full scale of any other input.



Connections

- | | | |
|---|----------------------|-------------------------|
| 1 | +Signal | |
| 2 | -Signal | |
| 3 | -Excitation / Screen | |
| 4 | +Excitation | |
| 5 | +Excitation | (6 wire load cell only) |
| 6 | External Calibration | (6 wire load cell only) |

Controls

- | | |
|---|-------------|
| 1 | Fine Gain |
| 2 | Coarse Gain |
| 3 | Zero |

Channel DIL Switches

- 1-4 Selects to which channel bus the amplifier output is connected.
Select one and only one.

Setting Up

With no load on the pin and the CAL switch OFF, adjust the zero control for 0.00Vdc on the selected channel bus test pin.

Either by using a known dead weight or by using the CAL switch, adjust the coarse and fine gain controls to give the voltage specified in the Configuration section.

Re-check the zero condition and repeat as necessary.

Ensure the CAL switch is OFF when setting up is complete.

Specification

Input sensitivity for 8V on channel

0.2mV/V to 17mV/V (2mV to 170mV), adjustable coarse & fine

Zero adjustment

±0.5mV/V

Bridge excitation

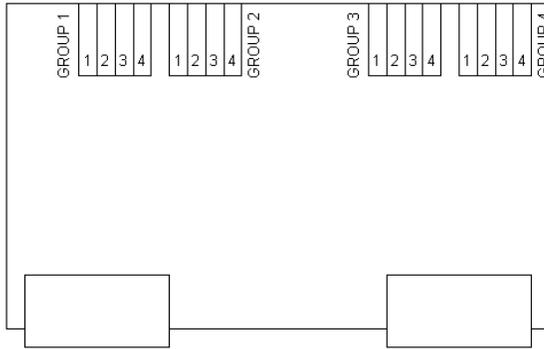
10Vdc @ 100mA

Current consumption

12mA + bridge current (28mA for 350Ω bridge)

MAX-030 Summation Board (PCB 5048)

This board contains four different summation amplifiers, each feeding a separate group. The different channels can be selected, by dil switches, for addition by any or all of the summation amplifiers, in any combination. The voltage on any group is equal to the average of that group's selected channel voltages.



Group 1 DIL Switches

1-4 Selects which channels are to be added to the group 1 bus.
Select any or none of four.

Group 2 DIL Switches

1-4 Selects which channels are to be added to the group 2 bus.
Select any or none of four.

Group 3 DIL Switches

1-4 Selects which channels are to be added to the group 3 bus.
Select any or none of four.

Group 4 DIL Switches

1-4 Selects which channels are to be added to the group 4 bus.
Select any or none of four.

Operation

The voltage on a particular bus is equal to the average of the voltages on the selected channels.

Any channel can be added to any number of groups, and any group can have any number of channels.

Specification

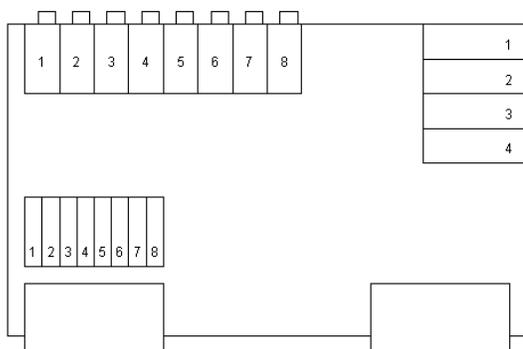
Current consumption

2mA

MAX-035 8 Way Switching Board (PCB 5058)

This board contains adjustments to allow up to seven different channels or groups to be switched to any other channel or group, with varying gains.

An external 3-bit logic switch selects which channel or group is the input, and a dil switch selects any unused channel or group for the output.



Connections

- 1 Switch Common
- 2 LSB Switch
- 3 NSB Switch
- 4 MSB Switch

Controls

	MSB	NSB	LSB	
1	OPEN	OPEN	OPEN	Channel 1 Differential Gain
2	OPEN	OPEN	CLSD	Channel 2 Differential Gain
3	OPEN	CLSD	OPEN	Channel 3 Differential Gain
4	OPEN	CLSD	CLSD	Channel 4 Differential Gain
5	CLSD	OPEN	OPEN	Group 1 Differential Gain
6	CLSD	OPEN	CLSD	Group 2 Differential Gain
7	CLSD	CLSD	OPEN	Group 3 Differential Gain
8	CLSD	CLSD	CLSD	Group 4 Differential Gain

Channel/Group DIL Switches

- 1-4 Selects to which channel bus the selected input is connected.
- 5-8 Selects to which group bus (1-4) the selected input is connected.
Select one and only one from either bank.

Operation

A channel or group is selected, according to the external switch settings, and connected to any other channel or group, dependent on the DIL switch setting. This allows any output board to be remotely switched between several different inputs.

Do not select as an output any channel or group which is already in use.

Setting Up

For each of the required external switch combinations, adjust the corresponding control to set up the correct differential gain to give correct output for the selected input.

Specification

Differential gains

0% to 100%, independently adjustable

Current consumption

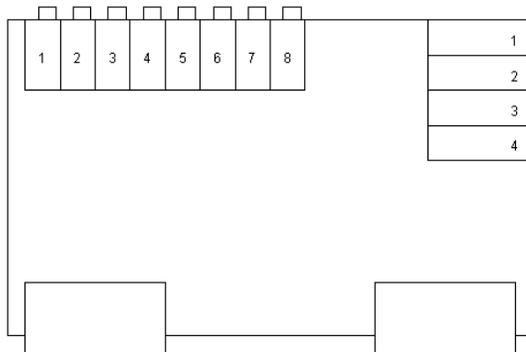
6mA

MAX-040 8 Level Trip Set Board (PCB 5054)

This board contains adjustments to allow up to eight different trip voltages to be set as ratios of the expected full scale output.

An external 3-bit logic switch selects one of these eight voltages and applies it to the trip 1 bus.

Derived user defined ratios (normally 90% and 5%) of the trip 1 bus voltage are applied to the trip 2 bus and trip 3 bus.



Connections

- 1 Switch Common
- 2 LSB Switch
- 3 NSB Switch
- 4 MSB Switch

Controls

	MSB	NSB	LSB
1	CLSD	CLSD	CLSD
2	CLSD	CLSD	OPEN
3	CLSD	OPEN	CLSD
4	CLSD	OPEN	OPEN
5	OPEN	CLSD	CLSD
6	OPEN	CLSD	OPEN
7	OPEN	OPEN	CLSD
8	OPEN	OPEN	OPEN

Setting Up

For each of the required external switch combinations, adjust the corresponding control to give the voltage specified in the Configuration section.

The controls set the voltage on the trip 1 bus for different combinations of the external switches. The corresponding voltages on the trip 2 and trip 3 busses are pre-defined ratios of the trip 1 bus, normally 90% and 5% respectively.

Specification

Trip 1 voltages

0V to 10V, independently adjustable

Current consumption

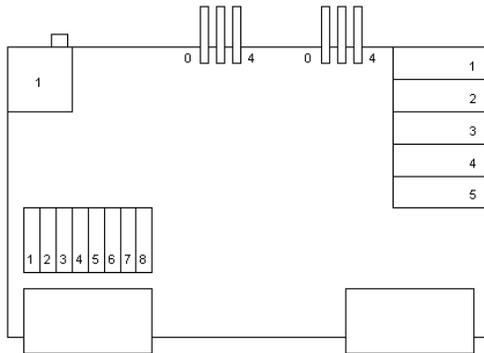
20mA

MAX-050 Voltage Output Board (PCB 5053)

This board can provide $\pm 10V$, $\pm 5V$ or $\pm 2V$ output for a full scale input.

A dil switch selects which channel or group is connected to the voltage driver.

A gain control allows the output voltage to be scaled numerically to the applied load.



Connections

- | | |
|---|----------------------|
| 1 | $\pm 10V$ Full Scale |
| 2 | $\pm 5V$ Full Scale |
| 3 | $\pm 2V$ Full Scale |
| 4 | 0V |
| 5 | No Connection |

Controls

- | | |
|---|-----------|
| 1 | Fine Gain |
|---|-----------|

Channel/Group DIL Switches

- | | |
|-----|--|
| 1-4 | Selects which channel bus varies the output voltage. |
| 5-8 | Selects which group bus (1-4) varies the output voltage. |
- Select one and only one from either bank.

Setting Up

Adjust the fine gain control for the desired output voltage corresponding to the applied load on the selected channel/group.

Specification

Outputs for 8V on channel or group

$\pm 10V$, $\pm 5V$, $\pm 2V$, all $\pm 2\%$ adjustable

Current consumption

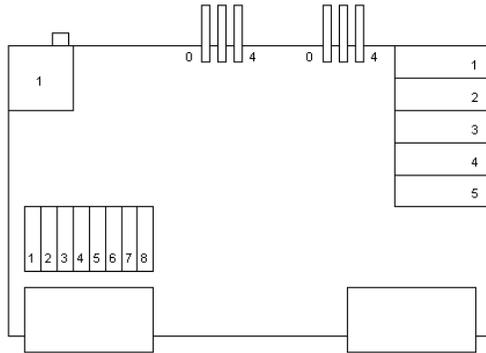
4mA

MAX-060 Current Output Board (PCB 5053)

This board can provide either 0-20mA or 4-20mA output for a full scale input, selectable by jumpers.

A dil switch selects which channel or group is connected to the current driver.

A gain control allows fine adjustment of the 20mA output.



Connections

- 1 No Connection
- 2 No Connection
- 3 No Connection
- 4 Return
- 5 20mA Full Scale

Controls

- 1 Fine Gain

Channel/Group DIL Switches

- 1-4 Selects which channel bus varies the output current.
- 5-8 Selects which group bus (1-4) varies the output current.
Select one and only one from either bank.

Links

- 0 Set BOTH pairs of links for minimum current of 0mA.
- 4 Set BOTH pairs of links for minimum current of 4mA.

Setting Up

Adjust the fine gain control for the desired output current corresponding to the applied load on the selected channel/group.

Specification

Output for 8V on channel or group

20mA, $\pm 2\%$ adjustable

Output for 0V on channel or group

0mA or 4mA, selectable

Current consumption

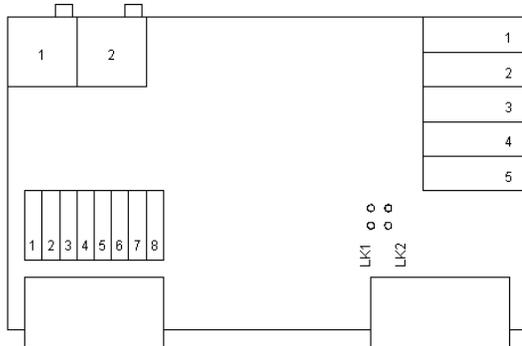
8mA + output current (max. 22mA)

MAX-070 Serial Output Board (PCB 5045)

This board provides a continuous data stream at 2400 Baud, both RS-232 and RS-422, and is therefore suitable for driving both the **LCM CDD-408-2** and **LCM CWI-LED**, as well as the **LDD** range of large digit displays.

A dil switch selects which channel or group is connected to the serial driver.

A gain control and range setting jumpers allow the output data to be scaled numerically to the applied load.



Connections

- 1 RS-422 'A'
- 2 RS-422 'B'
- 3 Common / 0Vdc
- 4 +12Vdc
- 5 RS-232 TxD

Controls

- 1 Coarse Gain
- 2 Fine Gain

Channel/Group DIL Switches

- 1-4 Selects which channel bus varies the output data.
- 5-8 Selects which group bus (1-4) varies the output data.
Select one and only one from either bank.

Links

- | | | |
|---------|------|------|
| Display | LK1 | LK2 |
| nnnn | OPEN | OPEN |
| nn.n | OPEN | CLSD |
| nn.nn | CLSD | OPEN |
| n.nnn | CLSD | CLSD |

Setting Up

Adjust the coarse and fine gain controls for the desired data output corresponding to the applied load on the selected channel/group.

Specification

Protocol

2400 baud, 8 data bits, no parity, 1 stop bit
RS232 & RS-422

Output for 8V on channel or group

"0100" to "9999", adjustable coarse & fine

Aux. power supply

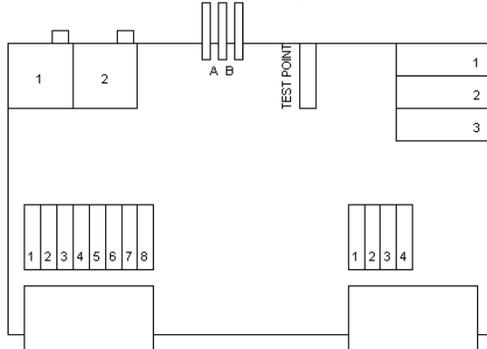
+12Vdc

Current consumption

75mA + aux. current (60mA for LCM CDD-408-2, 44mA for LCM CWI-LED)

MAX-080 Relay Output Board (PCB 5050)

This board contains a voltage comparator with two inputs, *signal* and *reference*. A dil switch selects which channel or group is connected to the *signal* input. Another dil switch selects which trip is connected to the *reference* input. Alternatively, an on-board *reference* can be adjusted as a ratio of the expected full scale output and set, via the dil switch, to be local to this board or to be the master of any trip (in which case the **MAX-040** should not be used). When the voltage on the *signal* input exceeds the voltage on the *reference* input, the relay (fitted with change-over contacts) will energise. Alternatively, a jumper can be set which will cause the relay to de-energise under this condition, to give fail-safe operation.



Connections

- 1 Normally Closed (closed when relay de-energised)
- 2 Normally Open (open when relay de-energised)
- 3 Common

Controls

- 1 Local Trip Set

Channel/Group DIL Switches

- 1-4 Selects which channel bus operates the trip.
- 5-8 Selects which group bus (1-4) operates the trip.
Select one and only one from either bank.

Trip DIL Switches

- 1-3 Selects which trip bus sets the trip.
Select only one, or none. If none is selected, the local control must set the trip.
- 4 If on, the local control sets the trip and is master of whichever trip bus is selected, if any.
If off, the local control is redundant and the trip must be set elsewhere on any one of the trip busses.

Local Setting Up

If the local trip control is to be used, adjust it to give the voltage specified in the Configuration section.

Link

- A The relay will energise when the voltage on the selected channel/group bus is below the trip set voltage.
(The relay will de-energise when the voltage on the selected channel/group bus is above the trip set voltage)
This gives fail-safe operation.
- B The relay will energise when the voltage on the selected channel/group bus is above the trip set voltage.
(The relay will de-energise when the voltage on the selected channel/group bus is below the trip set voltage)

Specification

Contact rating

Single pole changeover, 10A 28Vdc/120Vac

Reference voltage

0V to 10V, adjustable

Current consumption

44mA

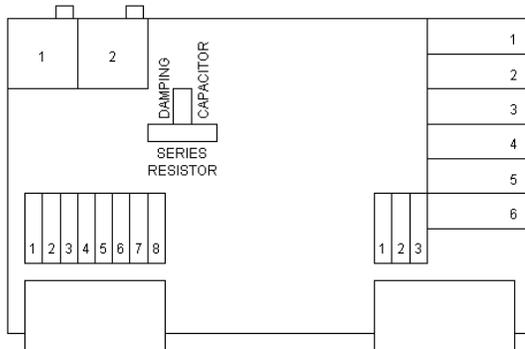
MAX-090 Meter Output Board (PCB 5052)

This board provides $\pm 2V$ output for a full scale input. Although specifically designed to drive the **LCM CDA-308** digital display, it is also suitable for driving an analog meter with typically 1mA fsd.

Internal damping can be modified by changing a single resistor.

Dil switches select which channel, group or trip is connected to the meter driver.

A gain control allows the meter to be scaled numerically to either the applied load or trip load, as appropriate.



Connections

1	+12Vdc
2	+5Vdc
3	0Vdc
4	-5Vdc
5	$\pm 2V$ Full Scale
6	0Vdc

Controls

1	Coarse Gain
2	Fine Gain

Channel/Group/Trip DIL Switches

- 1-4 Selects which channel bus varies the output signal.
- 5-8 Selects which group bus (1-4) varies the output signal.
- 1-3 Selects which trip bus varies the output signal.
Select one and only one from any bank.

Setting Up

Adjust the coarse and fine gain controls for the desired output reading corresponding to the applied load on the selected channel/group.

There is provision for a series resistor and/or a damping capacitor to be fitted, so that analog meters with low fsd current and/or poor mechanical damping may be accommodated.

Specification

Output for 8V on channel or group

20mV to 2V, adjustable coarse & fine

Aux. power supplies

+12Vdc, $\pm 5Vdc$ @ 100mA

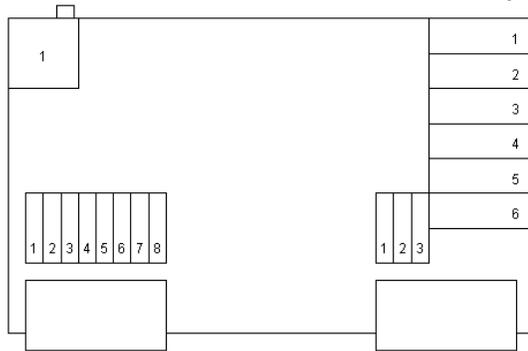
Current consumption

14mA + aux. currents (18mA for LCM CDA-308)

MAX-100 Traffic Light Output Board (PCB 5049)

This board is used to drive an external 3 level lamp and buzzer pendant, such as the **LCM RAG**, and contains three voltage comparators each with two inputs, *signal* and *reference*. A dil switch selects which channel or group is connected to the *signal* inputs. The trips are connected to the respective *reference* inputs. Alternatively, an on-board *reference* can be adjusted as a ratio of the expected full scale output and set, via the dil switch, to be the master of trip 1. Derived user defined ratios can then be applied to trip 2 and trip 3 (in which case the **MAX-040** should not be used).

As the voltage on the *signal* input increases above the voltage on trip 3, the green lamp illuminates. Similarly, when the voltage on trip 2 is exceeded, so the amber lamp illuminates and the buzzer sounds intermittently. As the voltage on trip 1 is exceeded, the final red lamp comes on and the buzzer sounds continuously.



Connections

1	+12Vdc
2	Buzzer
3	Red
4	Yellow
5	Green
6	0Vdc

Controls

1	Full Scale Set
---	----------------

Channel/Group DIL Switches

- 1-4 Selects which channel bus operates the traffic light.
- 5-8 Selects which group bus (1-4) operates the traffic light.
Select one and only one from either bank.

Trip DIL Switches

- 1-3 Selects which trips that the local control is master of.
Select any, or none. If none, the local control is redundant and the thresholds must be set elsewhere on the trip bus.

Setting Up

If the local full scale control is to be used, adjust it to give the voltage specified in the Configuration section.

The control sets the voltage on the trip 1 bus. The corresponding voltages on the trip 2 and trip 3 busses are pre-defined ratios of the trip 1 bus, normally 90% and 5% respectively.

Operation

The voltage on the trip 1 bus sets the level at which the red light illuminates and the warning buzzer sounds continuously.

The voltage on the trip 2 bus sets the level at which the amber light illuminates and the warning buzzer sounds intermittently.

The voltage on the trip 3 bus sets the level at which the green light illuminates.

Specification

Reference voltage

0V to 10V, adjustable

Aux. power supply

+12Vdc

Current consumption

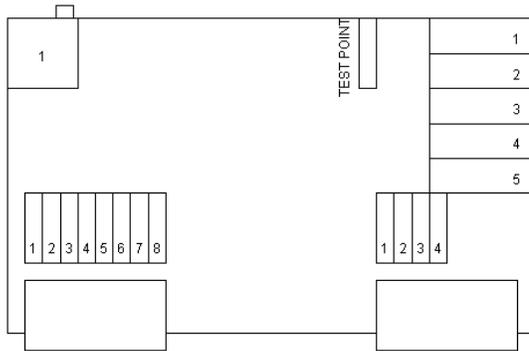
32mA + aux. current (260mA for LCM RAG)

MAX-110 ±Ladder Output Board (PCB 5051)

This board is used to drive an external graduated led display, such as the **LCM WW-440**. This type of display requires two inputs, *signal* and *reference*. A dil switch selects which channel or group is connected to the *signal* input. Another dil switch selects which trip is connected to the *reference* input. Alternatively, an on-board *reference* can be adjusted as a ratio of the expected full scale output and set, via the dil switch, to be local to this board or to be the master of any trip (in which case the **MAX-040** should not be used).

As the voltage on the *signal* input increases, so increasing numbers of leds on the display illuminate until, as the voltage on the *reference* input is exceeded, the final red led comes on.

A bi-directional (centre zero) display can also be connected to this board.



Connections

- 1 +12Vdc
- 2 -Signal
- 3 +Signal
- 4 Full Scale
- 5 0Vdc

Controls

- 1 Local Full Scale Set

Channel/Group DIL Switches

- 1-4 Selects which channel bus operates the ladder.
- 5-8 Selects which group bus (1-4) operates the ladder.
Select one and only one from either bank.

Trip DIL Switches

- 1-3 Selects which trip bus sets the full scale.
Select only one, or none. If none is selected, the local control must set the full scale.
- 4 If on, the local control sets the full scale and is master of whichever trip bus is selected, if any.
If off, the local control is redundant and the full scale must be set elsewhere on any one of the trip busses.

Local Setting Up

If the local full scale control is to be used, adjust it to give the voltage specified in the Configuration section.

Specification

Reference voltage

0V to 10V, adjustable

Aux. power supply

+12Vdc

Current consumption

8mA + aux. current (92mA for LCM WW-440)