CDM9

CONDUCTIVITY CONTROLLER

OPERATION GUIDE

Preface

Product guarantee

This instrument has a guarantee against defects in materials and workmanship for a period of three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective.

Limitation of guarantee

The foregoing guarantee does not cover damage caused by accidental misuse, abuse, neglect, misapplication or modification.

No guarantee of fitness for a particular purpose is offered. The user assumes the entire risk of using the product. Any liability of LTH is limited exclusively to the replacement of defective materials or workmanship.

There are no user serviceable parts, including fuses etc., within the unit. Any attempt to dismantle the instrument will invalidate the guarantee.

Disclaimer

LTH Electronics Ltd reserves the right to make changes to this manual or the instrument without notice, as part of our policy of continued developments and improvements.

All care has been taken to ensure accuracy of information contained in this manual. However, we cannot accept responsibility for any errors or damages resulting from errors or inaccuracies of information herein.

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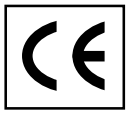
Manufacturing Standards



Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations called up by the European EMC Directives.

Safety

This instrument has been designed to comply with the standards and regulations called up by the European Low Voltage Directive using BS EN 61010-1 : 1993

Quality

This instrument has been manufactured under the following quality standard: ISO 9001:2000. Certificate No: FM 13843

Note: The standards referred to in the design and construction of LTH products are those prevailing at the time of product launch. As the standards are altered from time to time, we reserve the right to include design modifications that are deemed necessary to comply with the new or revised regulations.

Contents

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1 Introduction

The CDM9 can be used with a wide range of LTH conventional conductivity cells to measure and control a broad spectrum of solution conductivity. Two versions of the basic CDM9 are available. The Wall-mount version, and the Panel-mount version. Three measurement ranges can be selected using a combination of switch settings and cell constants (1.0 and 0.1). The ranges are: -

- 0 - 19.99 µS/cm
- 0 - 199.9 µS/cm
- 0 - 1999 µS/cm

The CDM9 has an onboard volt-free changeover relay with an adjustable setpoint. It can be set to activate if the conductivity is above or below the setpoint. Therefore, the CDM9 can be used for a variety of dosing or bleeding applications. An LED on the front panel indicates the state of the relay.

Calibration is carried out at the factory and no further user calibration is needed. The setpoint can be checked and modified with the front cover fitted by using the switches on the front panel. The new style of digital setpoint adjustment allows setpoint adjustment of about 20 digits per step. This is perfectly adequate for this type of conductivity controller.

Manual temperature compensation can be switched in or out, and the process temperature is set using a PCB mounted potentiometer. A fixed 2 % / °C slope temperature compensation is standard.

Specifications

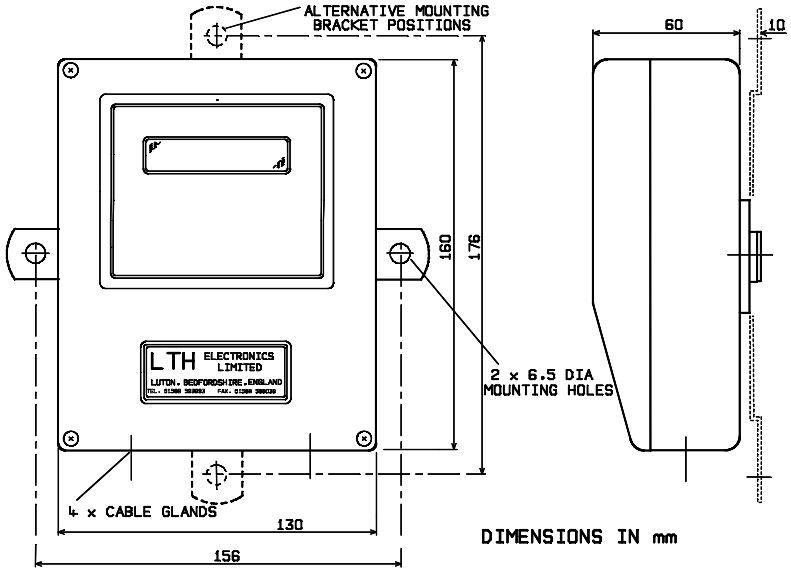
Cell types which can be used with the CDM9	CMC1/01 CMC1/10 CMC7/10 CMC8/01 CMC8/10 CMC32/10 CMC34/01 CMC34/10
Cable length	Up to 25 metres.
Operating frequency	Cell : approx 190Hz, sinusoidal
Ranges of measurement	0 - 19.99 µS/cm, 0 - 199.9 µS/cm, 0 - 1999 µS/cm
Conductivity accuracy	2% of reading ± 2 digits
Linearity	1% of range
Repeatability	1% of range
Ambient temperature	-20°C to +50°C for full specification.
Temperature variation	±0.02% of range / °C (typical)
Temp. compensation slope	Fixed 2% / °C over 0 - 100°C.
Temp. compensation point	Selectable by potentiometer 0 - 100°C.
Temp. compensation base	Fixed at 25 °C.
Display	3½ digit back-lit LCD, 20 mm character height
Control relay	Adjustable setpoint with volt free contacts (5A 250V AC). Hysteresis 1% fsd. A red LED indicates the relay is ON.
EMC : Immunity	BS EN 50082-2:1995
EMC :Emissions	BS EN 50081-1:1994
LVD : Safety standard	BS EN 61010-1:1993
Power supply	110V or 230V AC, 50/60 Hz, user selectable, 3W max.
Panel-mount housing	Flame retarding ABS plastic in grey
Panel-mount weight	Less than 800 grams (CDM9 only)
Panel-mount environmental	IP66 to the front when correctly mounted in a panel
Panel-mount dimensions	96 x 96 x 140 mm (H, W, D) including connectors
Wall-mount housing	Flame retarding ABS plastic in pale grey
Wall-mount weight	Less than 800 grams (CDM9 only)
Wall-mount environmental	IP66 in all directions
Wall-mount dimensions	160 x 130 x 65 mm (H, W, D) excluding mounting brackets

2 Installation

This chapter describes how to install the wall-mount, rail-mount, pipe-mount and panel-mount versions, and how to connect the unit to auxiliary equipment and a power source.

Wall-mount version

The wall-mount version is designed for fixing to a wall or other flat surface using the brackets provided.



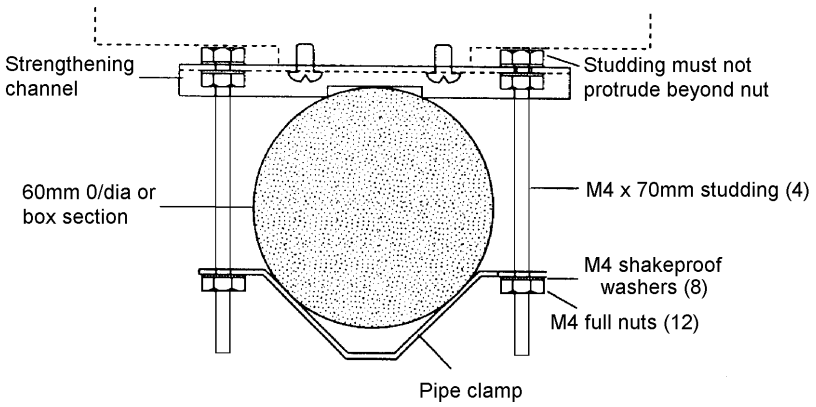
Mounting brackets and dimensions

The brackets should be attached, either horizontally or vertically, to the back of the CDM9 using the four M4 pan head screws provided.

Rail-mount and pipe-mount versions

The rail- & pipe-mount brackets are designed for fixing the wall-mount version to a vertical or horizontal handrail or pipe, of 25 mm min. to 60 mm maximum outside diameter. The rail-mounting kit comprises two channels, two clamps and appropriate studs, nuts and washers, as shown in the exploded view below.
To mount the rail-mount version proceed as follows:

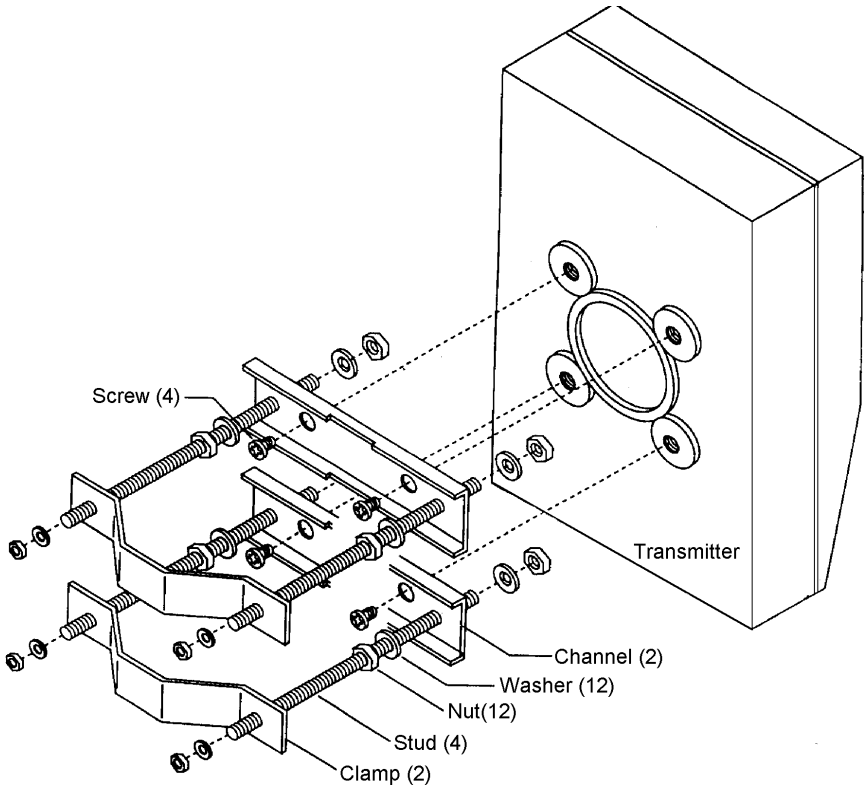
- Attach the four studs to the channels using four pairs of nuts and washers as shown in the following diagram. The studding must not protrude beyond the nut on the flat side of each channel
- Attach the two channels to the rear of the CDM9, using the four Posidrive screws provided.
- Attach to the pipe using the two clamps and fasten with nuts and washers, as above



Rail-mounting & pipe-mounting brackets

Note: the brackets can be fitted vertically or horizontally

Rail-mount and pipe-mount versions (…continued)

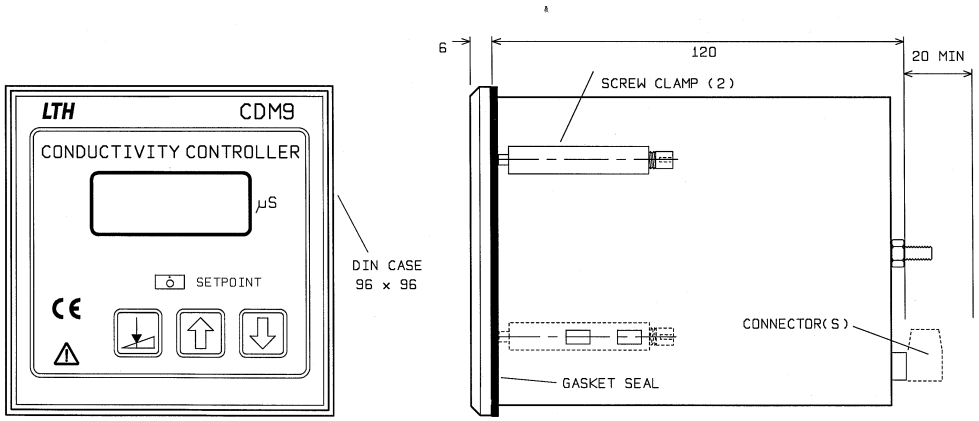


Exploded view of the rail and pipe fixing clamp assembly.

Note: the brackets can be fitted vertically or horizontally

Panel-mount version

The panel-mount version is designed to be flush mounted and sealed in a square cut-out in a panel, and is held in place with the two screw clamps provided.



Dimensions of panel-mount unit

- The panel cut-out for the unit should be 92 mm x 92 mm (+1.0 – 0.0).
- A sealing gasket is supplied: fit it around the edge of the cut-out.
- Two screw clamps are supplied and are fitted from the back of the instrument.
- Ensure the gasket is correctly positioned before tightening the clamps.
- A badly fitted gasket will not give a good seal to the specified IP rating.

Special installation instructions

Part of the method of EMC compliance is a strict limitation on the way in which all signal, supply and control cables are terminated at both the instrument and source or destination. It is essential that the types of cables which have been recommended (or direct replacements) are used. With the wrong cable fitted, incorrect readings will result.

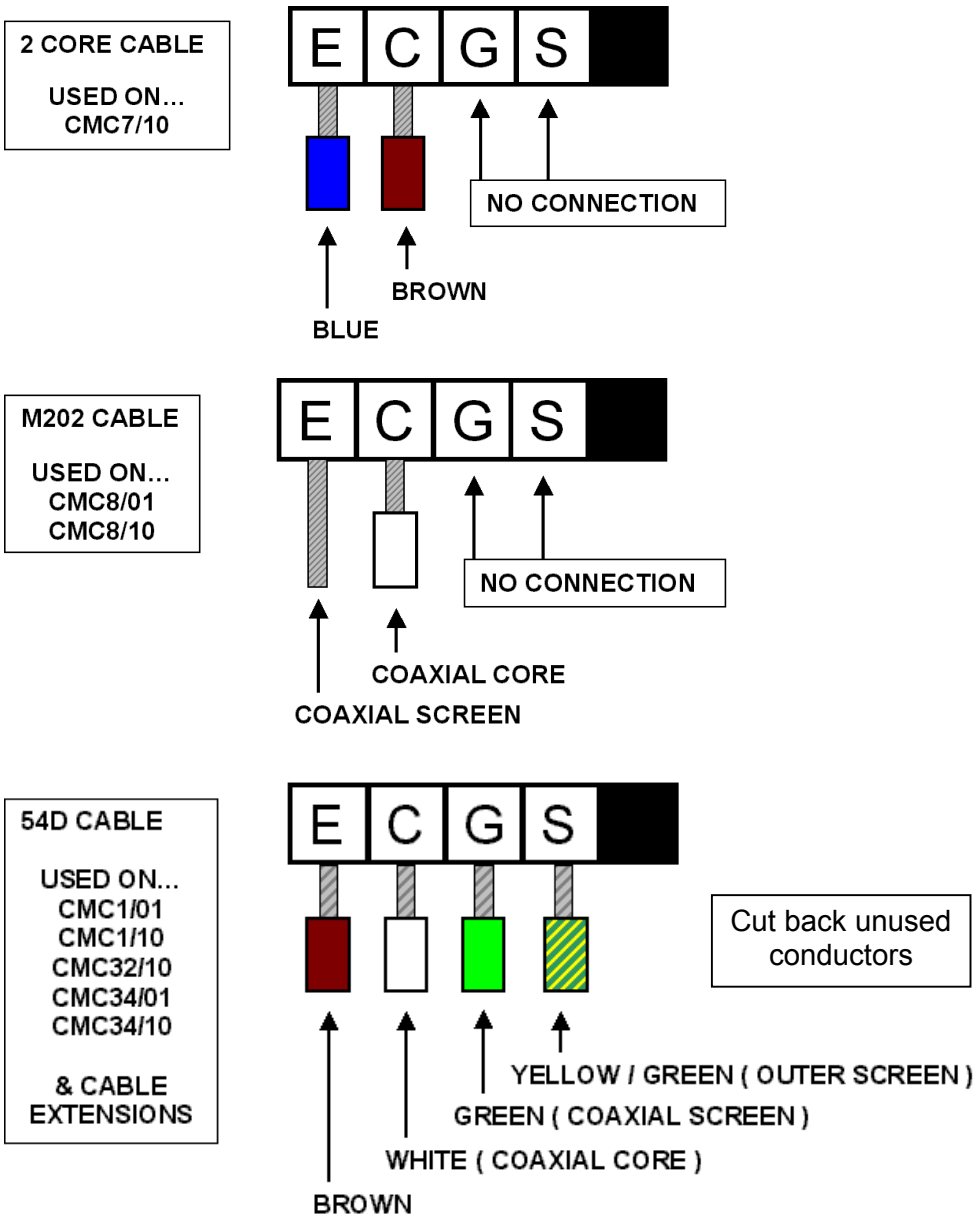
If these installation instructions are followed carefully and precisely, the instrument will achieve and maintain the levels of EMC protection stated in the specification. The equipment to which it is connected must also have the same or similar EMC control to maintain operation without undue interference to the whole system.

- Terminations at the connectors should have any excess wire cut back so that a minimal amount of wire is left free to radiate electrical pick-up inside the instrument housing.
- The instrument housing must be correctly re-assembled and securely fastened, to maintain a continuous electro-magnetic shield around the instrument.
- An Earth connection must be made to the Earth terminal of this instrument, both for SAFETY and to keep the EMC protective shield at Earth potential.

Connections and Controls (general)

CAUTION: Before installing or making any changes to the High Voltage terminals, ensure the mains power has been switched off and cannot be switched back on by accident during wiring of the instrument.

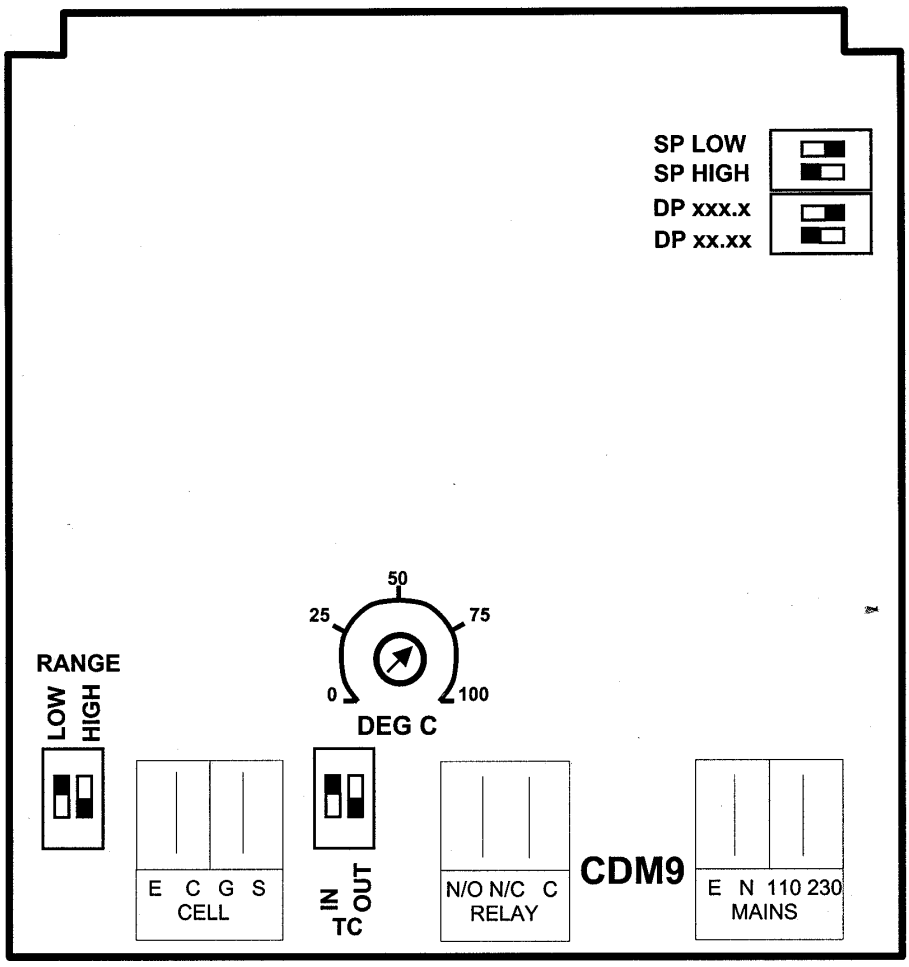
Connections to the CDM9 are made through terminal blocks, accessible by removing the front panel on the wall-mount version, and at the back of the instrument for the panel-mount version. The following diagrams of the CDM9 connections also show the position of the calibration controls that are referred to in the section on setting up the instrument.



SENSOR WIRING DIAGRAMS FOR CDM9P AND CDM9S

Connections and Controls (Wall-mount version)

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.



CDM9 Wall-mount control and connection details (PCB view)

Wall-mount version connections (general)

This applies to all cables and cable glands for all installations.
After each cable has been connected up, pull most of the cable slack back through the cable gland to prevent any unwanted RF energy being radiated inside the housing. Make sure you do not tension the cable within the instrument. Tighten the cable gland onto the cable so that it grips sufficiently to seal and to prevent the cable from being pulled back through the gland. Any unused cable glands should be sealed with a blanking plug to maintain the IP rating.

Wall-mount version cell input connections

The Conductivity cell is supplied pre-wired with either LTH Coax (M202) or 2 Core (3182Y) cable. Up to 25 metres of extra cable may be used with the CDM9. Extension of the standard cable length can be made with either a plug & socket arrangement, or a junction box, but always using the LTH 54D cable. Any other cable extension will adversely affect the instrument. Cut back any unused conductors. Do not use them for other connections.

Feed the cell cable through the left-hand cable gland [the largest cable gland on the instrument]. Do not use any other type of cable than those recommended by LTH to extend the cell / instrument distance. Connect the conductivity cell to terminals E,C and G and the outer cable screen to terminal S. None of the cable screens should be connected together at any time.

Wall-mount version cell wiring

Determine the type of cable being terminated. Extension cables are of the 54D type.
A cell wiring diagram has been included in the previous Connections and Controls (general) part of this section.

Wall-mount version power supply connections

Remove the plastic mains cover as follows. Squeeze the top of the mounting post with fine pliers or similar and then lift the cover clear of the terminals.
Feed the mains supply cable through the outer right hand cable gland. Do not use individual strands of wire if it is necessary to achieve an IP66 level of environmental seal. Connect the power supply to the terminals as required.
Replace the plastic mains cover if relay connections are not required.

Wall-mount version relay connections

Remove the plastic mains cover (unless already removed above) as follows. Squeeze the top of the mounting post with fine pliers or similar and then lift the mains cover away from the terminals.

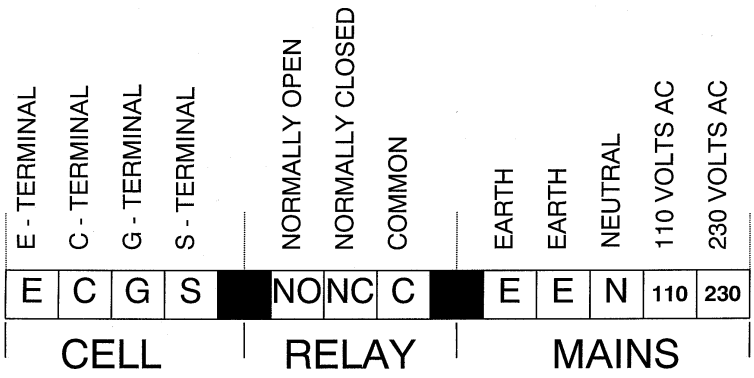
The relay contacts are connected to the I/O terminals only and are not powered from the instrument itself. They must be connected in series with a supply, a load and a 5 Amp fuse. An arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay .

Feed the relay cable through the inner right hand cable gland. Do not use individual strands of wire if it is necessary to achieve an IP66 level of environmental seal. Connect the load to the terminals marked NO, NC and C, as required.

Pull most of the cable slack back through the cable gland to prevent any unwanted R.F being radiated inside the housing. Make sure you do not tension the cable within the instrument. Tighten the cable gland onto the cable so that it grips sufficiently to seal and to prevent the cable from being pulled back through the gland. **Replace the plastic mains cover.**

Connections and Controls (Panel-mount version)

DISCONNECT the mains power to the instrument and the control relays before making



changes to connections at the back of the instrument.

CDM9 Panel-mount connection details (rear view)

Panel-mount version connections (general)

Do not tension any of the cables so that it strains the instrument connectors.

Panel-mount version cell input connections

The Conductivity cell is supplied pre-wired with either LTH Coax (M202) or 2 Core (3182Y) cable. Up to 25 metres of extra cable may be used with the CDM9. Extension of the standard cable length can be made with either a plug & socket arrangement, or a junction box, but always using the LTH 54D cable. Any other cable extension will adversely affect the instrument. Cut back any unused conductors. Do not use them for other connections.

Do not use any other type of cable than those recommended by LTH to extend the cell / instrument distance. Connect the conductivity cell to terminals E, C, G and S as shown in the table below. Neither of the cable screens should be connected together at any time.

Panel-mount version cell wiring

Determine the type of cable being terminated. Extension cables are of the 54D type. A cell wiring diagram has been included in the previous Connections and Controls (general) part of this section.

Panel-mount version power supply connections

Connect the power supply to the power terminals as required.

Panel-mount version relay connections

The relay contacts are connected to the terminals at the back of the instrument only and are not powered from the instrument itself (volt free contacts). They must be connected in series with a supply, a load and a 5 Amp fuse. A contact arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay. Connect the load to the relay terminals marked NO / NC / C as required.

Noise suppression (all versions)

In common with other electronic circuitry, the CDM9 may be affected by high level, short duration noise spikes arising from electromagnetic interference (EMI) or radio frequency interference (RFI). To minimise the possibility of such problems occurring, the following recommendations should be followed when installing the unit in an environment where such interference could potentially occur.

Potential noise sources

The following noise generating sources can affect the CDM9 series through capacitive or inductive coupling.

- relay coils
- solenoids
- AC power wires, particularly at or above 100V AC
- current carrying cables
- thyristor field exciters
- radio frequency transmissions
- contactors
- motor starters
- business and industrial machines
- power tools
- high intensity discharge lights
- silicon control rectifiers that are phase angle fired

The CDM9 is designed with a high degree of noise rejection built in, to minimise the potential for interference from these sources, but it is recommended that you apply the following wiring practices as an added precaution.

Recommended wiring practices

- All the wiring should conform to local codes and practices.
- Cables transmitting low level signals should not be routed near contactors, motors, generators, radio transmitters or wires carrying large currents.

Reducing interference

If noise sources are so severe that the instrument's operation is impaired, or even halted, the following external modifications should be made, as appropriate:

- Fit arc suppressors across active relay or contactor contacts in the vicinity.
- Run signal cables inside earthed steel trunking as much as practical.
- Use the internal relays to switch external slave relays or contactors when switching heavy or reactive loads.
- Fit an in-line mains filter close to the power terminals of the instrument.

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3 Operation and setting up

Introduction

This chapter explains the best and quickest set-up method for this equipment. Carefully follow the procedures below systematically to ensure optimum performance from your instrument. Remember that a little extra time spent getting this right can make a lot of difference in terms of efficiency savings, maintenance calls, faulty installations and so on.

Setting up your controller

To set up a CDM9 ensure that the instrument and cell have been installed in accordance with all the requirements of Section 2. Configure the option switches according to the following pages.

The switch tables that follow have been designed for ease of installation with minimum chance of incorrect settings. Each switch table has a specific function. Each function should be carefully considered and the switches set accordingly.

If in doubt contact LTH Electronics or your local distributor for technical support.

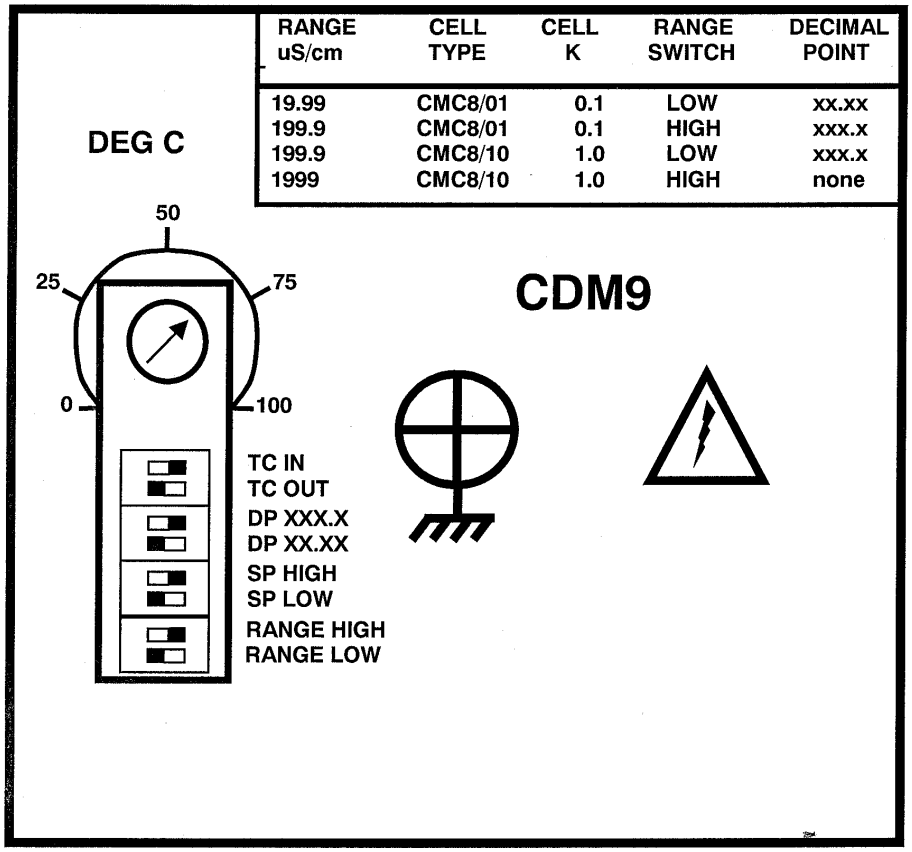
Wall-mount version access to setup controls

REFER TO THE DRAWING IN THE INSTALLATION SECTION
Unscrew and remove the instrument housing cover. DO NOT REMOVE the clear plastic the mains connection protective cover. If it has been removed, replace it before applying power to the terminals.

DO NOT ADJUST ANY OF THE BLUE FACTORY PRE-SET POTENTIOMETERS

Panel-mount version access to setup controls

REFER TO THE FOLLOWING DIAGRAM
Access to these controls is at the back of the instrument. It is not necessary to remove the instrument from the panel, nor to dismantle the instrument.



CDM9 Panel-mount switches and potentiometer (rear view)

Set the operating range

Three operating ranges are available with the CDM9. These are : 19.99 µS/cm, 199.9 µS/cm and 1999 µS/cm. Note: 1999 µS/cm = 1.999 mS/cm. The range is selected by changing the position of two PCB mounted switches as shown in the table below.

Range Low	Range High	K	Cell Type	Operating / Display Range
Off / Open	On / Closed	1.0	CMCxx/10	Display Range = 1999 µS/cm
Off / Open	On / Closed	0.1	CMCxx/01	Display Range = 199.9 µS/cm
On / Closed	Off / Open	1.0	CMCxx/10	Display Range = 199.9 µS/cm
On / Closed	Off / Open	0.1	CMCxx/01	Display Range = 19.99 µS/cm

Set the display decimal point

To locate the decimal point switches refer to the Wall-mount or Panel-mount figures in this section as necessary.

Note: the decimal point position on the display depends on the operating range as selected. Use either DPxxx.x or DPxx.xx or turn both switches off to set the required decimal point position, as shown in the table below. After setting the switches, check that the displayed reading is correct.

DP xx.xx	DP xxx.x	Display Decimal Point Position
Off / Open	Off / Open	Display Range = 1999 µS/cm
Off / Open	On / Closed	Display Range = 199.9 µS/cm
On / Closed	Off / Open	Display Range = 19.99 µS/cm

Set the Process Temperature

The temperature compensation must first be enabled by setting the temperature compensation switches to on. To get the best out of the CDM9, set the process temperature potentiometer equal to the process temperature. It is not necessary to be precise in many applications. If the process to be controlled varies across a range of temperatures, select the optimum temperature at which the greatest accuracy is required. An alternative strategy is to set the compensation temperature half way between the expected high and low temperature ranges.

Set Temperature Compensation in or out

The temperature compensation can be disabled by setting the temperature compensation switches to out. To get the best out of the CDM9, set the compensation switches to TC IN, as detailed below. Set the temperature scaled TC slope potentiometer to the appropriate value for the solution being controlled (if you do not know the actual value, 2%/°C is a good first approximation for many solutions. For further advice, consult LTH Electronics.

TC IN	TC OUT	Temperature Compensation Status
Off / Open	On / Closed	Temperature compensation switched OFF
On / Closed	Off / Open	Temperature compensation switched ON
Off / Open	*Off / Open*	*Illegal set-up for temperature compensation*
On / Closed	*On / Closed*	*Illegal set-up for temperature compensation*

Select the setpoint mode

Note: The relay fitted to the CDM9 is of the changeover type. The choice of wiring configuration to be made here is whether the relay is to be used to dose chemicals (increase the conductivity) or to bleed a system (decrease the conductivity). In either case, the relay wiring selected should permit the system to fail in a safe way (usually to de-energise the load) if the power fails. The setpoint LED indicates that the relay is in an energised state.

SP LOW	SP HIGH	Control Relay Action
Off / Open	On / Closed	Energised if conductivity greater than setpoint (HIGH)
On / Closed	Off / Open	Energised if conductivity is less than setpoint (LOW)
Off / Open	*Off / Open*	*Illegal set-up for Relay setpoint*
On / Closed	*On / Closed*	*Illegal set-up for Relay setpoint*

Front panel switch operation

Four tactile switches on the front panel are used to operate the CDM9. One of the switches is a secret (hidden) switch. This helps eliminate accidental adjustment and unauthorised tampering. The functions of these switches are as follows:

	Setpoint switch displays the setpoint value if pressed and held. Must also be pressed and held together with the security switch during any changes to the setpoint.
	Increments the setpoint if used with the setpoint and security switches. Momentary presses for small adjustments or press and hold for large adjustments.
	Decrements the setpoint if used with the setpoint and security switches. Momentary presses for small adjustments or press and hold for large adjustments.
	Hidden security switch. When pressed and held together with the Setpoint switch, it allows the setpoint to be changed. It prevents unauthorised adjustment of the setpoint if not pressed and held. To locate it, press the area between the CE Mark and Warning Triangle.

IMPORTANT … To change the Setpoint, you must press and hold down both the Security and Setpoint Switches, together with either the Up or Down Buttons. The Security button has been incorporated to prevent unauthorised changes being made to the Setpoint.

Set the relay setpoint

See the keypad Figure above, showing the appearance of the setpoint switches.
The setpoint LED is lit when the relay is energised. A single momentary acting push button switch on the front panel, when held down, displays the Conductivity setpoint on the digital display.
To change the setpoint you must hold down both the setpoint switch and the security switch, and either the up or down buttons as explained in the next step until the display shows the desired setpoint value. To change the setpoint one step at a time, press the up or down buttons momentarily. To change the setpoint more rapidly, hold down the up or down buttons. After about 3 seconds, the setpoint accelerates rapidly.
Relay action and setpoint hysteresis can be checked by slowly adjusting the setpoint control above and below the measured conductivity value. If the Setpoint action is incorrect, change both SP LOW and SP HIGH over, then repeat the test.

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4 Fault finding

Introduction

Note: There are no user serviceable parts inside the instrument.

DO NOT ADJUST ANY OF THE BLUE FACTORY PRESET POTENTIOMETERS

If you have adjusted any presets, the unit will have to be returned to the factory or local agent for recalibration.

Fault finding hints are included in this section. If the fault has not been cleared after these checks have been carried out, contact LTH or their nominated representative. Please have as much of the following information available as possible in any communication with LTH, to enable a quick repair or diagnosis of the problem to be made:

- Serial number of the instrument.
- The approximate date of purchase.
- Details of the application.
- Electrical environment and supply details.
- Circumstances under which failure occurred.
- The nature of the fault or faults.
- Relay loads, cables and lengths.
- The cell type, cable length and serial number.

Note: most faults are due to incorrect wiring or cell mounting. It is essential that the conductivity cell is measuring a representative sample and that all connections are correct.

It is often worthwhile to check the measurement by an independent method, for example, by use of a portable conductivity meter or by titration.

See also Reducing interference and Special installation instructions.

Fault check lists

Instrument appears dead

- Using a voltmeter, check the power supply voltage at the input connector.
- Check that the connections are correct, i.e. 110V and N or 230V and N.
- Check the Earth connection is valid, for EMC grounding purposes.
- There are no fuses fitted inside the instrument.

The reading is over-range or under-range

- Ensure the input is correctly connected and the cell is not clogged, coated or damaged.

- Check that the correct range, temperature setting and decimal point have been selected on the instrument, and the correct cell is being used.
- Check the cell and its cable for possible short circuits.
- Consider that the conductivity may be higher than the range of the instrument.
- Check the correct cell constant has been selected and installed.
- The CDM9 does not measure and correct for variable temperature. It is necessary to have a stable process temperature or for the effect to be unimportant to the measurement and process control.
- Check that any in-line junction boxes and extension cables have been fitted and wired up correctly.

The display is unstable

- Ensure that the conductivity cell is compatible with the CDM9 and that it is in good condition, i.e. not physically damaged or coated with various deposits such as oil, silicone, limescale, suspended solids etc.
- Ensure that the mains voltage supply to the unit is in the right terminals, and that the wire insulation has been cut back to give a good connection.
- Ensure that a film or coating of a contaminant has not formed over the electrodes, as this will give false readings. Even a fingerprint on the carbon or steel electrode can alter the readings significantly.
- Check the flow past or through the cell is constant and representative, and that a partial blockage has not formed.
- Instability may be due to trapped air or cavitation occurring within the cell. Check the position of the cell.

The display reads zero

- Check for open circuit cell or cell cable.
- Check for damage to the connecting cable.
- Check that all input connections are secure.
- Check the cell is wired up correctly.
- Check that the cell bore is not blocked or filled with air.
- Check the cell is immersed in the correct solution.

The display shows incorrect readings

- Check the solution conductivity by an independent method.
- Check that the cell is clean and completely immersed in the solution.

Instrument display appears to malfunction

- Switch the instrument power off and on again.
- Check that the display back-light is on, indicating power is reaching the unit.

Conductivity reading appears incorrect

- Low reading due to incomplete immersion or contamination of the electrodes.
- There may be some trapped matter within the cell bore.

- High conductivity readings may be caused by a short circuit or leakage into the cell.
- The cell should be checked, when dry, with an ohmmeter. Disconnect it at the instrument and check the resistance between the E and C terminals. It should be greater than 50 MΩ between E & C.
- If using 54D extension cable, check the leakage from E & C in turn to the screens (inner and outer). 50 MΩ should be the minimum isolation resistance between them all.
- Low conductivity can be caused by accumulation of trapped air or gas coming out of solution. Check that no "air traps" exist in the cell installation.
- High conductivity readings caused by leakage of solution into the cell. This usually indicates that the cell material has been fractured and the cell must be replaced.
- If another conductivity cell is available, this can be used to determine whether the fault lies with the instrument or the cell.
- Check that the cell cable is not damaged or broken and that the outer screen does not make contact with any other terminals or metal work.
- Check the inner screen does not contact other terminals or metalwork at the cell end. It should not be grounded.
- Check the cell cable is sufficiently distant from power cables or electrical noise sources.
- Check that the correct cell type has been installed.
- Check that the correct range has been selected.
- Check that the calibration procedure has been followed precisely.
- Check the cell cable is no longer than 30m in total.

Poor control of the process

- Ensure the cell is clear of obstacles. Check that the opening has not become blocked.
- Ensure the cell is measuring a representative sample of the solution.
- Make sure there is thorough and rapid mixing of any solution additives.
- See that the flow rate of additives is sufficient to achieve the desired effect.
- The flow of additives must not be so great that a cyclic concentration profile develops.
- The point of additive entry should give good mixing, not in a dead zone of the tank.
- Ensure there is no cavitation in the system.
- Make sure the cell is sited close enough to the required point of measurement.
- Check that the setpoints have been correctly setup.

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5 Guarantee and service

Products manufactured by LTH Electronics Ltd are guaranteed against faulty workmanship and materials for a period of three years from the date of despatch, except for finished goods not of LTH manufacture, which are subject to a separate agreement.

All cells made by LTH are thoroughly tested to their published specification before despatch. As LTH have no control over the conditions in which their cells are used, no further guarantee is given, although any complaints concerning their operation will be carefully investigated.

Goods for attention under guarantee (unless otherwise agreed) must be returned to the factory carriage paid and, if accepted for free repair, will be returned to the customer's address free of charge. Arrangements can also be made for repair on site, in which case a charge may be made for the engineer's time and expenses.

If any services other than those covered by the guarantee are required, please contact LTH direct.

Note: Overseas users should contact their LTH agent. Special arrangements will be made in individual cases for goods returned from overseas.

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6 Index

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